Appendix A40.3 – Bats

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1 Introduction

1.1 General Background

1.1.1 This report is one of the appendices supporting Chapter 40 (Ecology and Nature Conservation) of the AWPR Environmental Statement. It considers the potential impacts on bat populations associated with the Fastlink of the proposed scheme. The results of the surveys carried out for the purpose of this assessment are also presented and are shown on Figures 40.4a-f and Figures 40.5a-f.

1.1.2 The three component route sections in this report for the Fastlink of the proposed scheme are as follows:

- Section FL1: Stonehaven to Howieshill (ch0-3200);
- Section FL2: Howieshill to Cookney (ch3200-6300); and
- Section FL3: Cookney to Cleanhill Junction (ch6300-10200).

1.1.3 All tables and figures are structured in this manner.

1.1.4 The Ecological Impact Assessment (EcIA) and were undertaken with regard to the 'Design Manual for Roads and Bridges (DMRB) Volume 10 and 11 (Highways Agency, 2001) and the Environmental Impact Assessment (Scotland) Regulations 1999, along with cognisance of draft Institute of Ecology and Environmental Management (IEEM) guidelines.

1.1.5 These studies included desk-based consultation to collate existing information about bat populations in the study area for the proposed scheme and field surveys to provide current data about the status of bat populations and the habitats that support them.

Aims

1.1.6 The purpose of the survey and assessment was to:

- assess the presence and status of bat populations and their habitats in the study area;
- determine the presence of roosts and availability of potential roosts in the study area including those in trees, buildings and other man-made structures;
- determine and assess the value of foraging and commuting habitats/features within the study area for bats;
- assess the potential impacts of the proposed scheme on the local bat population and their habitats; and
- identify appropriate mitigation measures and determine any residual impacts.

1.2 Background to Assessment

Biology

1.2.1 There are 16 species of bat (Order Chiroptera) known to be resident in the British Isles, ten of which have been recorded in Scotland (Gorman et al, 1996):

- Common pipistrelle bat (*Pipistrellus pipistrellus*);
- Soprano pipistrelle bat (*Pipistrellus pygmaeus*);
- Nathusius' pipistrelle bat (*Pipistrellus nathusii*);
- Brown long-eared bat (*Plecotus auritus*);

- Noctule bat (*Nyctalus noctula*);
- Leisler's bat (*Nyctalus leisleri*);
- Daubenton's bat (*Myotis daubentonii*);
- Natterer's bat (*Myotis nattereri*);
- Whiskered bat (*Myotis mystacinus*); and
- Brandt's bat (*Myotis brandtii*).

1.2.2 Seven of these species have been recorded in Aberdeenshire (Isobel Davidson, Aberdeen Bat Group, pers. comm.), five of which are known to breed there: common and soprano pipistrelle, brown long-eared, Daubenton's and Natterer's bats. There have also been isolated sightings of Nathusius' pipistrelle near Aberdeen and Leisler's bats have been recorded foraging near Peterculter although the population status of these species in the region is currently unclear (Rob Raynor, SNH, pers.comm.). The three pipistrelle species are collectively referred to hereafter as pipistrelles although each species is known as common, soprano or Nathusius' pipistrelle.

1.2.3 Bats have evolved a number of behavioural, physiological and morphological features connected with their ability to fly and their nocturnal activity patterns (Kunz, 1982). British bats are entirely insectivorous and have a complex sonar system known as echolocation that enables bats to find their insect prey and navigate around their environment at night. Echolocation involves emitting a rapid series of high frequency calls and then interpreting the returning echoes to build up a picture of their surroundings.

1.2.4 Bats' habitat requirements vary widely both on an individual and species level although certain features such as woodland edges and freshwater pools support high densities of insects and are therefore often focal points for foraging bats (Walsh et al., 1996a and 1996b). Of the bats found in Scotland, Natterer's and brown long-eared bats mainly forage in woodland environments whilst Daubenton's forage chiefly in areas associated with water. Pipistrelle bats are generalist in their feeding strategies and forage around waterbodies, woodlands, hedgerows and pasture (Altringham, 2003).

1.2.5 Linear habitat features such as rivers, hedgerows, roads and woodland edges are important to bats, which use these as landmarks in order to commute from one location to another (Schofield and Mitchell-Jones, 2003). Distances that bats travel between roosts and foraging areas are variable both within and between species. For example, brown long-eared bats may travel up to 2.8km from the roost site but spend most of their time foraging within 0.5km of the roost, whereas pipistrelles may forage up to 5.1km from the roost. Other British species may travel further than this (Entwistle et al., 1996).

1.2.6 Bats use different types of roosts at different times of the year and different roosts within the breeding season. Between late October and March bats hibernate. This requires an unexposed roost with a stable temperature, typically a cave, mine, cellar or tunnel. Around March, bats emerge from hibernacula sites and move to their summer roosts, typically within man-made structures or suitable crevices in trees. Some of these roosts are used regularly (i.e. every summer) and for substantial periods of time, whereas others serve as 'transitional roosts' being used for only one or two days every year or temporarily (e.g. for one season only). Mating takes place between late August and early December, either at the winter hibernating site or at autumn mating sites. Births occur the following summer. The numbers of bats using roosts can vary from single bats to hundreds of bats in a nursery colony or hibernation site (Altringham, 2003).

Legal and Conservation Status

1.2.7 All British bat species are listed on Schedule 5 to the Wildlife and Countryside Act (1981) (as amended) (WCA) and protected under Section 9 of the WCA. This affords bats protection against killing, injuring or taking and intentional or reckless damage, destruction or obstruction of roost sites, irrespective of occupation status. These actions all constitute offences under the WCA. In Scotland the WCA has been amended by the Nature Conservation (Scotland) Act 2004 which extends the legal protection afforded to Schedule 5 species such as bats. By law, a roost is any structure or place used for shelter or protection. Since bats tend to reuse the same roosts, the roost is protected whether the bats are present or not. Prosecutions for unlawful killing or injuring of bats may result in a fine of up to £5000 per bat and a possible jail sentence.

1.2.8 The EU Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) places a legal requirement on all Member States of the EU to protect specified species and habitats through their own domestic legislation. In the UK, the Habitats Directive has been implemented through the Conservation (Natural Habitats, and c.) Regulations 1994 (the Habitats Regulations). All species of bat are included in Annex IV of the Habitats Directive, which requires that they are given full legal protection.

1.2.9 All species of bat, except for the common pipistrelle, are listed on Appendix II of the Council of Europe Convention on European Wildlife and Natural Habitats (the Bern Convention 1979) to which the UK is a signatory, and ensures conservation and protection of all wild plant and animal species listed and special protection to the most vulnerable or threatened. The Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention) was adopted in 1972, came into force in 1983 and provides for the protection, through management agreements, of certain migratory species including bats which are listed on Appendix II. The Agreement on the Conservation of Bats in Europe (EUROBATS) came into force in 1994.

1.2.10 Bat populations have declined considerably during the last century, with Britain's native species being subject to enormous changes in their habitats. Drainage of wetlands, woodland clearance and agricultural intensification have affected bats through loss of roosting sites and reductions in insect abundance and diversity. Recent research has suggested that the conservation status and estimated UK population sizes of the seven species occurring in Aberdeenshire are either improving, stable or show no clear trend as shown in Table 1.

Table 1 – British Bat Species Populations and Status (Source: MacDonald and Baker 2005; JNCC 2005)

Species	UK (Scotland) Population Estimate	Conservation Status	Population Trend
Brown long-eared bat	245,000 (27,500)	Not threatened	No clear trend
Natterer's bat	148,000 (17,500)	Not threatened	Increasing
Daubenton's bat	560,000 (40,000)	Not threatened – conservation concern	Increasing
Common pipistrelle	2,430,000	Not threatened – UK priority species	Increasing
Soprano pipistrelle	130,000	Not threatened – UK priority species	Stable
Nathusius' pipistrelle	16,000	Not known	Not known
Leisler's bat	28,000 (250)	Scarce, Near threatened (IUCN)	No clear trend

1.2.11 Any assessment of development impacts must take into account the legal obligation to ensure that declines in bat populations are avoided. In addition, any development must have regard to the targets and objectives of the Local and UK Biodiversity Action Plans (LBAP and UKBAP) for the species concerned.

1.2.12 *P. pipistrellus* and *P. pygmaeus* are priority species identified in the UK Biodiversity Action Plan and have a combined national Species Action Plan (Hutson, 1993; UK Biodiversity Partnership, 2005) which is in the process of being adopted by the North East Scotland Biodiversity Partnership. Pipistrelles are threatened by reduction in insect prey abundance due to agricultural intensification and loss of suitable habitat and flyways as well as disturbance of roosts and loss of maternity and winter roost sites in buildings and trees. The UK BAP presents the following targets toward which the proposed scheme must have regard to:

- maintain the existing population of *P. pipistrellus* and *P. pygmaeus*;
- maintain the existing geographical range of *P. pipistrellus* and *P. pygmaeus*; and
- restore the population size of *P. pipistrellus* and *P. pygmaeus* to pre-1970 numbers.

1.2.13 The North East Scotland Biodiversity Action Plan (BAP) contains a local Biodiversity Action Plan (LBAP) for Daubenton's bat which serves to highlight the need to protect this locally important species (Racey, undated). Although Daubenton's bats have relatively widespread distribution across the country they are listed as a species of conservation concern by the Biodiversity Steering Group due to threats from loss of roosts and changes in riparian vegetation and water quality. The LBAP presents a number of targets toward which the proposed scheme must contribute to:

- promote sympathetic management of habitats; and
- maintain up to date records and information on Daubenton's bat and its habitat through monitoring.

1.2.14 The LBAP lists a number of management prescriptions considered necessary for the attainment of these targets, including the identification and proper management of habitat associated with roosts, the improvement of riverine management and development of bankside vegetation and riparian woodland, the erection of bat boxes to supplement natural roosts, the monitoring of bat populations and offering of advice to landowners on appropriate habitat management practices.

1.2.15 Although brown long-eared and Natterer's bats do not have their own Action Plans in Aberdeenshire, they are thought to be rarer than common and soprano pipistrelle and Daubenton's bats, especially Natterer's bat for which only a small number of roosts is known. Nathusius' pipistrelle is also believed to be rare and no breeding colonies are known this far north (Sue Swift, University of Aberdeen, pers. comm.).

2 Approach and Methods

2.1 Consultation

2.1.1 Previous survey data and records are important to consider for an EIA as they often provide information on the use of a site over a longer period than individual surveys, and also form a basis for updating records of known populations.

2.1.2 An initial walkover survey was carried out in February 2006 to provide preliminary data on habitats and buildings which appeared to be of potential value to bats. These allowed the identification and prioritisation of areas requiring surveys and potential survey effort required for the summer survey season.

2.1.3 The Aberdeen Bat Group, North East Scotland Biological Records Centre (NESBReC), the University of Aberdeen and Scottish Natural Heritage (SNH) were approached for data regarding bats within 2km of the proposed scheme and for their advice and recommendations regarding ecological constraints and opportunities in the study area.

2.2 Survey Methods

2.2.1 The level of proposed survey effort was determined through professional judgement, best practice guidelines (Mitchell-Jones, 2004) and through advice from SNH at a meeting on 8 December 2005.

2.2.2 Bat field surveys were undertaken using two methods: an assessment of the landscape for its potential value to roosting, foraging and commuting bats, and an evaluation of bat activity carried out at select periods of dusk, dark and dawn. Surveys were carried out by suitably trained and licensed (where appropriate) ecologists. Data were recorded onto Ordnance Survey maps and scale 1:10,000 scale GIS map sheets, which formed the basis for the results (Figures 40.4a–f and 40.5a-f.

Study Area

2.2.3 The study area for field surveys was defined with regard to specified standards (DMRB, 2001) and consideration was given to the six species likely to be present (Davidson, 2004; Richardson, 2000). The survey area extended 500m either side of the centreline of the road alignment giving a 1km wide study area. The size and locations of junctions were not finalised at the start of the survey season therefore not all land within 500m of the outer edge of these junctions is incorporated in the study area (see Section2.6). Although this is narrower than the ideal width for such surveys (DMRB, 2001), the final survey area and methods were agreed with SNH and preliminary surveys and desk study including information requests extended beyond 500m at these locations.

2.2.4 Due to difficulties in obtaining access (see Section 2.6), and the resulting impact on available time to complete the surveys, activity surveys and buildings (i.e. potential roost sites) within 200m of the proposed road alignment were prioritised. Consequently buildings and activity surveys outside 200m are being completed during the 2007 survey season (see Section 3.2 for further detail on survey coverage achieved in summer 2006). However, habitat profiling surveys were completed throughout the 1km wide survey corridor.

Habitat Profiling

2.2.5 Where access was permitted, all habitat features including woodlands, water features, farm- and grassland, wetland, urban, linear features (walls and hedgerows), man-made structures, underground and rock outcrop features were examined and assessed for their potential value to foraging, commuting and roosting bats (Jenkins et al., 1998; Walsh and Harris, 1996 a and 1996b; Entwistle et al*.,* 1997).

2.2.6 Each habitat was then assessed for its potential for roosting, foraging and commuting according to the criteria shown in Table 2.

Table 2 – Habitat Profile Assessment

Bat Habitat Value	Roosting	Foraging	Commuting
High	Woodlands: High proportion of trees with roost potential (suitable roost sites and access points in cracks, crevices and other gaps) - > 1 tree in 50 with potential. Diverse choice of different roosts. Caves / tunnels / mines / ice houses with humid atmosphere and sheltered, stable temperature conditions. Low disturbance levels.	High insect abundance. Native woodland / trees / hedgerows offering shelter and diverse edge habitat, and open parkland, suitable for Leisler's bats. Slow flowing/still freshwater features with sheltered vegetated edges. Low disturbance levels from lighting, pollutants, human activity.	Continuous, unbroken linear feature providing shelter and / or foraging opportunities and connectivity with other landscape features including roost and foraging areas. Includes tree lines, woodland edge, hedgerows, waterways, walls, woodland tracks, road and drainage networks, buildings.
Medium	Roost sites and access points	Moderately high insect	Partly discontinuous feature

Bat Habitat Value	Roosting	Foraging	Commuting
	in cracks, crevices and gaps present but not ideal due to size, disturbance levels, exposure. Between 1 in 50 and 1 in 100 trees have roost potential.	abundance. Native woodland / trees / hedgerows offering some shelter and edge habitat. Fast flowing freshwater features offering little shelter.	(gaps up to 30m wide) offering some shelter and/ or foraging opportunities.
Low	No suitable roost sites or access points visible. Fewer than 1 tree in 100 has roost potential due to age or type of trees. High disturbance levels.	Conifer woodland, improved agriculture and built up areas with low plant diversity and/or insect abundance. Lack of shelter, poorly connected to roost sites and commuting routes. High disturbance levels from lighting, pollutants, human activity.	Discontinuous feature (gaps greater than 30m wide) offering no shelter and/ or isolated from potential roosting and/or foraging areas.

2.2.7 Classifying structures, trees and habitat in this way allowed prioritisation for closer examination and emergence/activity surveys. The results of the habitat profile assessment also formed the basis of the evaluation of Habitat Areas. Where no bat activity was observed, the evaluation of that site was based on the habitat profile assessment (refer to Section 2.4). Areas of low/no value to bats for roosting, commuting or foraging were excluded from the assessment to make the survey time more effective due to the size of the survey area and time/ access restrictions.

Potential Tree Roosts

2.2.8 Difficulties in obtaining permission to access land during the 2006 survey season, rendered it impractical to survey the entire area for every potential tree roost within the project timescale. As such, all isolated mature broadleaved trees were evaluated for roost potential and all wooded areas were given an overall assessment of suitability based on composite sampling of trees.

2.2.9 Trees were examined during the summer of 2006 and during the ongoing surveys in 2007 for signs of bats including insect remains, droppings, grease marks, urine stains, the presence of dead or live bats, smoothing or lack of cobwebs, all of which indicate the presence of bats or their resting places (Mitchell-Jones, 2004). In addition, trees were assessed for features of potential use as roosts, including loose bark, splits, cracks, woodpecker holes, knot holes and other hollows using an endoscope or binoculars where necessary. Trees were assigned to a roost potential category according to the criteria outlined below in Table 3 (which also includes categories for other types of roost structure).

Table 3 − Roost and Potential Roost Category

Main Category	Sub Category	Category description (trees)	Category Description (structures)	Indicator
1 (Roost)	a	Trees with direct evidence of current use by bats.	Buildings/man-made structures with direct evidence of current use by bats.	Sighting/hearing of bats (including emergence). Presence of fresh droppings/ staining.
	b	Trees with evidence of recent use by bats.	Buildings/man-made structures with evidence of recent use by bats.	Small numbers of old droppings/old staining, smoothing and lack of cobwebs. Roosts identified by personal communication from reliable source (e.g. property owner).
2 (Potential Roost)	a	Trees with high potential for use as roost.	Buildings/man-made structures with high potential for use as roost.	Presence of gaps, cracks, loose tiles, holes in roof, loose boards and potential access points Presence of cracks, splits, knot holes,

Main Category	Sub Category	Category description (trees)	Category Description (structures)	Indicator
				loose bark, woodpecker holes, snag ends and other hollows, etc.
	b	Trees with some potential for use as roost.	Buildings/man-made structures with some potential for use as roost.	Presence of dense ivy or other features of lower potential as roost sites. Presence of dense ivy cover or dead wood.
3 (No potential)	n/a	Trees with no or low potential for use as roost.	Buildings/man-made structures with low potential for use as roost.	No such features, isolated from foraging or commuting routes. No such features, immature, smooth bark or lack of branches, isolated from foraging or commuting routes.

Potential Roosts in Structures and Features Other Than Trees

2.2.10 Daytime assessments of every structure or feature including single buildings, small groups of man-made buildings and structures including farm buildings, private residences, outhouses, ice-houses, bridges, culverts, memorials and walls which could be potential roosts were carried out according to the criteria in Table 3.

2.2.11 Pipistrelle and brown long-eared bats are considered more likely to roost in buildings such as farmhouses, modern dwelling houses and cottages as such sites are warm enough to support roosting colonies including maternity roosts (Entwistle et al 1997; Jenkins et al 1998). Other species preferentially roost in other structures. For example, Natterer's bats prefer gaps in loose mortar in old barns and Daubenton's bats often roost in bridges (Mitchell-Jones, 2004). No underground structures such as caves and mines are known to be present in the study area.

Activity Assessment – Summer 2006

2.2.12 Activity surveys for the study area were carried out between June and early August 2006 using methods recommended by Mitchell-Jones and McLeish (Mitchell-Jones and McLeish, 2004).

2.2.13 Bat activity was assessed using a combination of visual observation and echolocation detection techniques. Bat detectors are capable of translating high frequency echolocation calls into sounds within human audible range using heterodyne techniques. Bat Box III, Pettersson D230, Stag bat boxes and Duet detectors were used for heterodyne techniques. Bat calls were interpreted by surveyors in the field. Activity data including species, location, and behaviour (including foraging, commuting, social calling) were recorded onto field maps and recording forms.

2.2.14 Evening emergence surveys: buildings identified as category 1a, 1b (roosts) and 2a (high potential roosts) during daytime surveys were monitored from 20 minutes before sunset and up to 2 hours after sunset. Emergence surveys were not carried out on category 2b roost (buildings/structures with some potential to be used as roosts) due to time constraints and it is possible that bat access points may have been missed during daytime surveys (see Section 2.6). Precise timing of emergence surveys was determined according to the onset of sunset. Surveyors were stationed adjacent to potential access points or walked slowly around the structure using hand held bat detectors to identify emerging bats. The time, species and number of bats observed emerging or carrying out other activity were recorded, along with details of direction of travel to or from the roost. A roost count/emergence survey form was completed on each visit. Due to time restrictions only one emergence survey was carried out at each potential roost. It is important to recognise that buildings where no bats were observed emerging on the particular night still have potential to be used by bats. This could occur due to several factors, including surveyors being unable to clearly view the area where bats emerged, bats remaining inside the roost due to unfavourable weather conditions (although all emergence surveys were carried out where possible when conditions were

favourable for bat foraging activity) or the fact that the bats were not using that particular building on the night of the survey due to roost 'switching' behaviour that several bat species perform.

2.2.15 Activity assessments: Two methods were used to identify bat activity within the survey area: activity surveys and commuting route surveys. There were two defined time periods within which these surveys were undertaken: between sunset and three hours after dusk and in the three hours before sunrise, to avoid the well-documented lull in bat activity in between. All activity surveys were completed during the 2006 survey period however, the majority of the commuting route surveys are being carried out during the 2007 survey period. Any records of commuting bats were made during activity surveys and from those commuting route surveys that were completed.

2.2.16 The walkover activity survey was undertaken by surveyors following a pre-defined route based on the combined findings of the Stage 1 ecological assessments, daytime habitat profile surveys and wider observations of field maps and aerial photographs. They were not undertaken in areas of low habitat value (e.g. open arable farmland) aside from incidental observations or where a feature of higher value was present (e.g. large, intact hedge linking distant areas of woodland), unless the area was likely to be directly affected by the proposed scheme.

2.2.17 Teams of up to two surveyors walked at a slow speed, stopping for two minutes where bats were observed in order to sample activity or at least every 100m. During the survey, detailed notes were made regarding species, number of bat passes (discrete bursts of bat echolocation), activity type (Foraging, Commuting, Social Calling) and specific behaviour (including direction of travel and use of features in the landscape, e.g. direction of travel, foraging over water or swarming around buildings). Bat activity surveys were undertaken at each of the potential habitat areas at least once in the survey period.

2.2.18 Potential commuting routes were identified during habitat profile surveys along linear features including tree lines, roads, woodland edges and watercourses. A number of commuting routes were identified as an incidental part of the activity surveys. Specific commuting route surveys involved a combination of manual and static bat detection techniques to identify the location, species, number and direction of bats.

2.2.19 The level of survey effort for the activity and commuting route surveys also varied as a result of access restrictions and to gain enough information on certain areas where high levels of activity were anticipated as a result of high roosting, foraging and commuting potential. For this reason, areas such as the Burn of Muchalls and Elrick Ponds were surveyed on more than one occasion.

Survey Weather Conditions

2.2.20 Bats will continue to feed in poor weather conditions including mist and light rain, although they will tend to remain torpid if cold temperatures accompany this (Altringham, 2003). As a general rule, the ideal conditions for surveys (most productive in terms of the body of data available) is for fine and calm conditions with little or no rain (Kunz, 1982). Surveys were carried out under the most ideal conditions available within the survey time-frame and the constraints of the project. Surveys were not carried out or were suspended in persistent rain or strong winds.

2.3 Refinements to Survey Methods

2.3.1 Two parts of the study area were surveyed twice: once in 2006 where the present route option overlaps with the superseded route option which was surveyed once in 2004. Daytime and evening surveys yielded only minor differences between the two survey periods which reflects the similarities in approach.

2.3.2 A number of changes were made to the bat survey methodology that was initially used for the for the assessment undertaken for the Northern Leg of the scheme in 2004 to incorporate recommendations made by SNH. In addition, the methods for the current assessment were refined

based on study area experience gained during the 2004 surveys that were carried out for the Northern Leg.

2.3.3 This section outlines the differences in the methodology followed during the bat survey period in 2006 (for the Southern Leg and Fastlink study areas) and the 2004 surveys (for the Northern Leg study area). The aims of the bat surveys remained unchanged.

Study Area

2.3.4 Further consideration has been given, where appropriate, to important features of value to bats that extend beyond the 1km study area and that were identified in preliminary walkover surveys undertaken in early 2006. The definition of study areas for detailed daytime and evening bat surveys has otherwise remained unchanged.

Habitat Evaluation

2.3.5 Daytime habitat evaluation survey methods (to identify habitats of potential importance to foraging, roosting and commuting bats) remained unchanged between the 2004 and 2006 surveys.

2.3.6 Daytime roost assessments of trees were standardised across the 1km study area so that all woodlands were sampled and all mature broadleaved stand-alone trees were assessed for roost potential irrespective of location within the study area during the 2006 survey period. This addresses the difficulties of using increased survey effort within 50m of an alignment that was subject to potential alteration, as for the proposed Northern Leg. Standardisation of methods across the study area also better enabled the identification of commuting routes between roost sites and foraging areas as recommended by SNH.

2.3.7 The categorisation of actual and potential roosts, foraging areas and commuting routes employed during the 2006 survey period was based on the refinement of the 2004 methodology and is considered to be the most efficient method of assessing the relative value or potential value of features. Assigning a numerical category to buildings and trees based on the availability of roost opportunities rather than the likelihood of being a roost was considered to reduce ambiguity as bats are known to use buildings and trees that can appear to be unsuitable. This is due, in part, to a greater degree of uncertainty on roost site selection and the detailed habitat requirements of bats, in comparison to other groups such as birds.

Activity Surveys

2.3.8 To take into account the recommendation that greater effort be channelled into the assessment of fragmentation and severance impacts on bats, it was agreed with SNH that separate commuting route surveys were undertaken as part of the bat activity surveys. These data will be included in an Environmental Assessment Report to be published during 2007.

2.3.9 There were slight differences in the timing of bat activity surveys with respect to time of day during the 2006 survey period to better reflect the periods of highest bat activity (Mitchell-Jones, 2004). The difference in the timing of activity surveys with respect to time of year between the 2004 and 2006 survey period is not considered to affect the applicability of activity survey data as both were undertaken during the optimal survey period for bat surveys (DMRB, 2001; Mitchell-Jones, 2004).

2.3.10 The methods used in selection of buildings for evening emergence and dawn swarming surveys did not differ significantly between the 2004 and 2006 survey periods. Surveys were undertaken during the optimal emergence/swarming times and concentrated on identification of bat roosts where impacts on bats were considered more likely.

2.3.11 The methodology used to identify areas of bat activity were altered to reflect the change in survey effort to identify commuting routes based on SNH recommendations. The 2004 survey method followed a transect based loosely on potential habitat areas while simultaneously identifying

connecting routes between them. The 2006 surveys focused exclusively on identifying habitat areas. The identification of commuting routes between these areas of habitat has been established through studies being completed in 2007. The methodology followed in 2006 also enabled more than one repetition of each transect, which gave a better representation of how each area was used by bats.

2.4 Evaluation of Nature Conservation Value

2.4.1 The evaluation section aims to assign a nature conservation value to the bat populations associated with habitat areas. Evaluation of the intrinsic nature conservation value of vegetation and habitat features themselves is included in the Terrestrial Habitats report in Appendix A40.1) and is discussed only where no bat activity was recorded.

2.4.2 The 'nature conservation value' or 'sensitivity' of a species is related to the wider importance of that species at the local, regional and national levels and is used to assess the value of discrete species populations within a given area.

2.4.3 All species of bats are afforded high levels of protection under the EC Habitats Directive and are classified as European Protected Species and are therefore considered to be of international importance in terms of legislation, although the ecological value of each site for bats must take into account the relative abundance of each species (Table 1). For example common and soprano pipistrelle bats are not rare or threatened in Aberdeenshire and despite their international protected status they are common in the region. The value attributed to a feature or Habitat Area is considered according to whether the site is used by bats, the size of the population and what the area is used for (e.g. foraging or commuting habitat). Where bats were not detected during field surveys, the value of the habitat or area is assessed in terms of its potential to support roosting, foraging or commuting bats (potential bat areas) based on the potential value to bats (low, medium or high) according to the methods described in Table 2.

2.4.4 Sites deemed necessary to maintain the viability of regionally significant populations of bats including large and scarce foraging resources and large maternity roost sites or hibernacula are considered to be of national ecological value. Sites necessary for maintaining the viability of local populations in the Aberdeen area, such as small roost sites, are evaluated as being of regional ecological value. Those sites deemed to be supporting bat populations, such as important foraging habitat or commuting corridors, are evaluated as being of county ecological value. Sites with potential to support bat populations considered to appreciably enrich the habitat resource within the local context are evaluated as being of local ecological value (see Table 4).

2.4.5 In addition, consideration has also been given to any conservation designations, desk study results and a review of available literature. The criteria used in the evaluation of features is based on the Ratcliffe Criteria (Ratcliffe, 1977) used in the selection of biological Sites of Special Scientific Interest (SSSI). Sites and features have been classified according to the general criteria identified in Table 4.

Table 4 − Evaluation of Ecological Receptor

Ecological Importance	Attributes of Ecological Receptor
International (European)	Habitats An internationally designated site or candidate site i.e. Special Protection Area (SPA), provisional SPA (pSPA), Special Areas of Conservation (SAC), candidate SAC (cSAC), Ramsar site, Biogenetic/Biosphere Reserve, World Heritage Site or an area which meets the published selection criteria for such designation. A viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat that are essential to maintain the viability of a larger whole. Any river classified as Excellent A1 and likely to support a substantial salmonid population. Any river with a Habitat Modification Score indicating that it is Pristine or Semi-Natural or Obviously Modified. Species Any regularly occurring population of an internationally important species, which is threatened or rare in the UK, i.e. a UK Red Data Book species or listed as occurring in 15 or fewer 10km squares in the UK (categories 1 and 2 in the UK BAP) or of uncertain conservation status or of global conservation concern in the UK BAP. A regularly occurring, nationally significant population/number of any internationally important species.
National (Scottish)	Habitats A nationally designated site i.e. Site of Special Scientific Interest (SSSI), Areas of Special Scientific Interest (ASSI), National Nature Reserve (NNR), Marine Nature Reserve, or a discrete area, which meets the published selection criteria for national designation (e.g. SSSI selection guidelines). A viable area of a priority habitat identified in the UK Biodiversity Action Plan (UK BAP), or of smaller areas of such habitat that are essential to maintain the viability of a larger whole. Any river classified as Excellent A1 and likely to support a substantial salmonid population. Any river with a Habitat Modification Score indicating that it is Pristine or Semi-Natural or Obviously Modified. Species A regularly occurring, regionally or county significant population/number of an internationally/ nationally important species. Any regularly occurring population of a nationally important species that is threatened or rare in the region or county (see local BAP). A feature identified as of critical importance in the UK BAP.
Regional (North East Scotland)	Habitats Sites that exceed the county-level designations but fall short of SSSI selection criteria. Viable areas of key habitat identified in the Regional BAP or smaller areas of such habitat that are essential to maintain the viability of a larger whole. Viable areas of key habitat identified as being of regional value in the appropriate SNH Natural Heritage Future area profile. Any river classified as Excellent A1 or Good A2 and capable of supporting salmonid population. Any river with a Habitat Modification Score indicating that it is Significantly Modified or above. Species Any regularly occurring, locally significant population of a species listed as being nationally scarce which occurs in 16-100 10km squares in the UK or in a Regional BAP or relevant SNH Natural Heritage Future area on account of its regional rarity or localisation. A regularly occurring, locally significant population/number of a regionally important species. Sites maintaining populations of internationally/nationally important species that are not threatened or rare in the region or county.
Authority area (e.g. County or District) Aberdeenshire /City of Aberdeen	Habitats Sites that are recognised by local authorities e.g. Sites of Interest for Nature Conservation (SINS) and District Wildlife Sites (DWS). County/District sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves (LNR). A viable area of habitat identified in County/District BAP or in the relevant SNH Natural Heritage Future area profile. A diverse and/or ecologically valuable hedgerow network. Semi-natural ancient woodland greater than 0.25 ha. Any river classified as Good A2 or Fair B and likely to support coarse fishery. Any river with a Habitat Modification Score indicating that it is Significantly Modified or above. Species Any regularly occurring, locally significant population of a species that is listed in a County/District BAP on account of its regional rarity or localisation. A regularly occurring, locally significant population of a county/district important species (particularly during a critical phase of its life cycle). Sites supporting populations of internationally/nationally/regionally important species that are not threatened or rare in the region or county, and are not integral to maintaining those populations. Sites/features that are scarce within the county/district or which appreciably enrich the county/ district habitat resource.

Ecological Importance	Attributes of Ecological Receptor
Local (Immediate local area or village importance)	Habitats Areas of habitat considered to appreciably enrich the habitat resource e.g. species-rich hedgerows, ponds etc. Sites that retain other elements of semi-natural vegetation that due to their size, quality or the wide distribution of such habitats within the local area are not considered for the above classifications. Semi-natural ancient woodland smaller than 0.25ha. Any river classified as Fair B or Poor C and unlikely to support coarse fishery. Rivers with a Habitat Modification Score indicating that it is Severely Modified or above. Species Populations/assemblages of species that appreciable enrich the biodiversity resource within the local context. Sites supporting populations of county/district important species that are not threatened or rare in the region or county, and are not integral to maintaining those populations.
Less than Local (Limited ecological importance)	Sites that retain habitats and/or species that are of limited ecological importance due to their size, species composition or other factors. Any river classified as Impoverished D and/or and with a Habitat Modification Score indicating that it is Severely Modified.

2.5 Impact Assessment

2.5.1 The approach to the assessment of impacts in terms of magnitude and significance is presented in Chapter 40 (Ecology and Nature Conservation), paragraphs 40.2.81 – 4.2.84 and Tables 40.6 and 40.7.

2.6 Limitations to Assessment

2.6.1 Seasonal constraints and delays in agreeing access led to some areas to be surveyed for the hibernacula, monitoring, emergence and activity surveys being incomplete.

2.6.2 Surveys are ongoing at the time of writing this report and the full results will be published in an Environmental Report later in 2007. Pending completion of these surveys, a provisional assessment on bats has been undertaken.

Health and Safety

2.6.3 Due to physical hazards and the presence of livestock and horses in fields throughout the survey area, it was not always possible to access all habitats of potential value during evening activity surveys. Alternative routes close to habitats of value were used wherever possible, however some small areas were not surveyed due to the potential risks to surveyors.

Access

2.6.4 Only a limited number of buildings were inspected internally for the presence of bats, due primarily to the difficulty of obtaining homeowner permission. Lack of access permission prevented assessment of a small number of properties during the day as well as limiting the number of properties surveyed in the evenings. As these surveys are currently being completed, assessments should be considered, at least in part, to be provisional.. However, preliminary analysis of 2007 survey data suggests that there will be no significant changes to the assessments in this report and it is envisaged that the further data will re-confirm the initial assessment.

Surveyor Expertise

2.6.5 While all survey work was supervised by ecologists with suitable levels of bat survey experience, the scale of the survey effort required resulted in surveyors with variable levels of expertise assisting with fieldwork.

2.6.6 All survey work was supervised by at least one of the following ecologists with suitable bat survey experience:

- Claire Hopkins (Assistant Ecologist, Jacobs) – Licensed bat worker, 4 years' experience with bat surveys;
- Graham Rankin (Senior Ecologist, Jacobs) – 5 years' experience with bat surveys;
- Jonathan Guarnaccio (Ecologist, Jacobs) – Licensed bat worker, 5 years' experience with bat surveys;
- Mark Jackson (Ecologist, Jacobs) – 3 years' experience with bat surveys;
- Katie Finlinson (Assistant Ecologist, Jacobs) – 2 years' experience with bat surveys;
- Robert Parkin (Arboriculturist, Jacobs) – trainee bat worker, 1 years' experience with bat surveys;
- Alex Hollands (Assistant Ecologist, Jacobs) – trainee bat worker, 1 years' experience with bat surveys;
- Nicola Tallach (Assistant Ecologist, MBEC) – 6 years' experience with bat surveys;
- Brian Arneill (Associate Surveyor, MBEC) – Licensed bat worker, over 10 years' experience with bat surveys; and
- David Coote (Ecologist, MBEC) – trainee bat worker, 1 years' experience with bat surveys.

Weather Conditions

2.6.7 Survey results are potentially influenced by recent and current weather conditions given that bat activity is reduced in poor weather. The prevailing weather conditions during the 2006 survey season were generally good for bat surveying, although surveys on several nights had to be abandoned due to rainfall. In June 2006, night survey temperatures ranged from 8 – 11 °C, with an average of 10 °C. July daytime temperatures were above the seasonal average, and night survey temperatures ranged from 12 – 22 °C, with an average of 15 °C. Surveys were carried out in the first two weeks in August only, however temperatures were below the seasonal average, with temperatures recorded on night surveys ranging from 8 – 13.5 °C, with an average of 11 °C.

Roost Location

2.6.8 While staining on trees indicates that bats may use certain trees infrequently, the nomadic nature of tree-dwelling bats makes tree roosts difficult to locate. Bats may spend only 1.75 days on average in one place before switching roost sites (Cowan, 2003). Similarly, roosts may be difficult to locate in buildings as access points are often very small and well-hidden and there may be no external indications that bats use the building. Whilst the method statement and recording system used to categorise potential roosts was considered robust and appropriate, it is possible roosts were not identified due to reasons as given above. The decision to perform emergence surveys only at buildings of a certain level of potential also means that some roosts may not have been identified. Due to the size and configuration of many of the buildings, it was not always possible to view all possible exit / access sites simultaneously during emergence surveys. Therefore, particularly if bats were roosting in single or small numbers, bats may have exited some buildings without being detected.

3 Baseline

3.1 Consultation Information

3.1.1 The North East Scotland Biological Records Centre (NESBReC) and the University of Aberdeen provided no recent data for the study area, although Aberdeen University has published a number of scientific papers of studies undertaken in the Aberdeenshire area (e.g. Rydell et al 1994). The Aberdeen Bat Group provided no roost details in the Study area, although a number of roosts are known to be located in Peterculter and Milltimber to the north of the study area.

3.1.2 A Leisler's bat was identified from the Dee Crossing at Peterculter on 29 June 1993 by researchers at Aberdeen University. Additional sightings have been made elsewhere on the River Dee (Drumoak, 15km south west of Aberdeen) and on two separate locations over the River Don (Rydell et al 1993). These are the most recent sightings recorded in Aberdeen and were thought to represent a population that had previously been overlooked or suggest that the species distribution is spreading.

3.2 Survey Results

3.2.1 This section of the report and Figures 40.4a-f and 40.5a-f present the main findings of field surveys.

3.2.2 Survey results are presented using a spatial framework that is based on a series of Habitat Areas that are defined in Appendix A40.1 (Terrestrial Habitats). Isolated areas of habitat such as waterbodies or wetland areas that are of particular value or potential value to bats such as groups of smaller features such as buildings or trees with value or potential value to bats and areas with collective value as a result of their proximity, connectivity or similarity to each other, are described according to their Habitat Area and cross-referenced accordingly. In each case, features within Habitat Areas have been identified regardless of whether or not bats were observed using them.

3.2.3 Bat activity results are shown separately from other results for each of the geographical sections, although bat activity results have been incorporated into the descriptions of features of interest to bats. Bat activity recorded outside the study area has not been included in the survey results or in the evaluation. It is indicated on mapping figures to show where activity surveys were carried out and to indicate where commuting or foraging routes of value outside the corridor connect with those inside the study area.

3.2.4 Figures 40.5a-f also show habitat of general value to bats including woodland, linear features, waterbodies and wetland areas, confirmed roosts and features with roost potential are identified with their suitability/roost potential category. Activity survey results are displayed with the location of the recorded activity along with details of behaviour observed (whether the bat was foraging or commuting). Bat flight lines are also marked where bats were observed to fly repeatedly along the same route or one or more bats were observed commuting along a linear landscape feature.

3.2.5 Areas where no bat activity is shown on the figures is not necessarily an indication that bats do not use an area, but may reflect the particular route followed by surveyors, the time when the surveyors passed the area or the prevailing weather conditions experienced. This limitation has been alluded to in Section 2.6 above. There are some instances where activity shown on the maps is not included in the activity survey results tables. This is due to sightings and observations made during emergence surveys.

Summary of Baseline Survey Coverage and Omissions

3.2.6 Figures 40.4a-f indicate where bat activity surveys were carried out, the routes followed by surveyors and the species, numbers and activity recorded. Activity surveys were completed for the whole study area as described in Section 2.2, focusing on habitats of value to bats. A number of potential commuting routes were identified across the study area, most of which are being surveyed in 2007. Of the 20 potential commuting routes identified, eight have been surveyed once in 2006 and will be resurveyed. The other 12 will also require surveys.

3.2.7 Due to access restrictions, eight of the 93 buildings/ properties within the study area were not surveyed during the day to determine their potential for roosting bats. These buildings require daytime surveys and if they are identified as roosts or potential roosts they will require emergence surveys. Six roosts identified during day surveys require emergence surveys to determine their use/ species present and 14 of the 41 buildings identified as having roost potential for bats require emergence surveys. These surveys are scheduled to be undertaken in 2007. All buildings surveyed and their roost potential category are indicated on Figures 40.5a-f. Buildings which were not

surveyed during the day due to lack of access permission are represented by an open circle in the maps. Those buildings where emergence surveys have yet to be carried out do not have a red or blue ring around them (see Figures 40.5a-f).

3.2.8 Where bat numbers were recorded as 'constant' or 'many' on activity survey forms this has been included in the following tables as 30+ and added to the total figure as 30. Where 'hundreds' of bat passes were recorded on survey forms a figure of 100 has been used to calculate the total number of passes and 100+ used in the tables to indicate that foraging was continuous with hundreds of bat passes.

3.2.9 Where no bat activity is shown on the figures this is not necessarily an indication that bats do not use an area but may reflect the particular route followed by surveyors, the time when the surveyors passed the area or the prevailing weather conditions experienced.

Section FL1

3.2.10 This section is characterised by large open and exposed areas of farmland along the eastern side of the corridor which are of limited value to foraging or commuting bats with the exception of linear features such a scrub lined tracks and field boundaries. The rest of the section is made up of areas of broadleaved, mixed and coniferous plantation. A shelterbelt composed of mature broadleaved trees runs adjacent to the B979, connecting with Slicewells Wood to the north and an area of mixed woodland beyond this on White Hill. This forms a continuous woodland habitat along the edge providing ideal foraging, commuting and potential roosting opportunities. Megray Burn flows more or less north to south through Section FL1, through Megray Wood, which is composed of coniferous plantation in the north and mixed willow and birch wet woodland and marsh in the south. The habitat edges and burn are of value to foraging and commuting bats. Limpet Burn, which joins Megray Burn within the woods, also forms a valuable linear feature connecting potential roost sites and foraging areas both inside and outside the study area .

3.2.11 This section includes four identified roosts in farm buildings in Habitat Area F3. Daytime surveys identified seven potential roosts, three of which have had emergence surveys carried out but no bats were observed emerging. The remaining four require evening emergence surveys to confirm their roost potential and two buildings remain un-surveyed due to access restrictions. These will require a daytime assessment and potentially emergence surveys. Two culverts over Megray Burn and Limpet Burn have medium roost potential. Potential tree roosts were identified within the shelterbelt along the B979, within the southern portion of Megray Wood and along the valley sides adjacent to Limpet Burn.

3.2.12 A total of 209+ bat passes were recorded. Of these passes, 158+ were foraging bat passes and 28 were commuting bat passes. Twenty-three were commuting/foraging passes attributed to common and soprano pipistrelles. Commuting routes were identified along Megray Burn, along the track between Megray Farm and Forester's Croft, in several places along the B979 where there is woodland adjacent to the road, along the edges and ride within Megray Wood and along Limpet Burn. Foraging areas were identified along the shelterbelt beside the B979, around New Mains of Ury Farm and Steading, along Limpet Burn, around Megray Wood and to the north beside the junction between Fishermyre Wood and the woodlands to the north of Fishermyre.

3.2.13 The results from bat surveying of Section FL1 are shown in Table 5 and Table 6, and in Figures 40.4a-b and 40.5a-b.

Table 5 – Specific Features Within Section FL1

Habitat Area	Feature	Feature Type	Description / Additional information
F1	Agricultural fields between the A90 and Stonehaven	Potential commuting along railway sidings and road	Series of agricultural fields with scattered scrub and low overall value to bats. Scrub, rank grassland and tall ruderal vegetation along the railway line provide limited foraging and commuting potential, due to high exposure levels. Amenity planting along the A90 also provides a potential commuting route of medium value, connecting potential roosts in Stonehaven with foraging habitat to the north, although the road may act as a barrier to direct crossings.
F2	Agricultural fields west of New Mains of Ury	Foraging area, potential roosting and commuting route	Large expanse of agricultural fields with low overall value to bats. Relatively species rich broadleaved shelter belts between fields and the road offer high commuting and roosting potential with several trees containing splits, cracks, loose bark, dead and missing limbs. Common pipistrelles recorded foraging along the length of the shelterbelt beside the road, which also represents a potential commuting route between the roost at New Mains of Ury (F3) and foraging opportunities at Megray Wood and Limpet Burn (F7) and Slicewells Wood (F5).
F3	Agricultural fields to the north of Megray Farm	Four roosts, potential roosts, foraging and commuting routes	Extensive area of arable fields with occasional scattered scrub are of low value to bats. Megray Burn is identified as a commuting route used by common pipistrelle and the scrub lined track from Megray Farm to Forester's cottage is an identified commuting and foraging route also used by common pipistrelle. New Mains of Ury Farmhouse was identified as a soprano pipistrelle roost with mature trees in the garden being used for foraging. New Mains of Ury Farm has one building identified as a common pipistrelle roost and one building identified as a potential roost. Megray Farm Steading and Forester's Croft were both identified as roosts with recent evidence of use during day surveys (category 1b). New Mains of Ury Cottages and Megray Farm are potential roosts (category 2a). One stone culvert on Megray Burn has medium potential as a roost.
F4	Woodland to the north-west of Megray Farm	Potential commuting route	Small pocket of relatively mature plantation woodland forms part of a pipistrelle bat commuting route along Megray Burn which runs through F3. The roosting potential of the trees however is low.
F5 (part)	Fishermyre Wood	Commuting route, potential tree roosts and foraging	A thin section along the eastern edge of this woodland is within the study area . The woodland as a whole is of high potential for foraging, roosting and commuting to all bat species, and is connected to known roosts at New Mains of Ury (F3) by a shelterbelt adjacent to F2. Common and soprano pipistrelle were recorded commuting along the woodland edge.
F6	Megray Wood	Commuting and foraging route, potential roost	Mature conifer plantation dominated by Sitka spruce provides low roosting potential. Potential commuting and foraging routes include Megray Burn, which runs through the uphill section, and open rides within the woodland, in addition to the plantation edges. The Habitat Area extends the more open and diverse foraging habitat along Limpet Burn (F7). Foraging and commuting common pipistrelle were identified along the northern and southern edges of the plantation and along one of the rides. Other edges are likely to be used in a similar manner. A culvert with medium roost potential was identified under the road on Limpet Burn.

Habitat Area	Feature	Feature Type	Description / Additional information
F7	Limpet Burn	Commuting, foraging, potential tree roosts	Mosaic of semi-natural communities including a dense marsh with scattered willow, birch woodland, dense bracken and continuous gorse provide high value foraging and commuting, connecting the fish ponds at the trout fishery and the potential roost (category 2a) at Logie Farm, with the scrub woodland and with the burn itself. The valley sides along the burn also provide additional shelter with several old, dead and damaged trees providing potential roost sites (category 2a). Common and soprano pipistrelle were recorded foraging and commuting along the length of the burn in this Habitat Area.
F8	Agricultural fields surrounding Coneyhatch and Wyndford Farm	Potential roosts, commuting route	Series of arable and improved fields, with occasional marshy grassland and scattered scrub with low value to foraging and commuting bats. Linear features including tracks and field boundaries have medium commuting potential. A commuting pipistrelle bat was recorded along the gorse lined road. The houses at Coneyhatch farm, Kempston Hill and Howieshill have potential as roosts (category 2a, 2b and 2b respectively). Two houses at Standingstones were not surveyed during 2006 due to lack of access permission and will require day and potentially emergence surveys during the 2007 survey period.
F9	Kempstone Hill	n/a	Scrub and heath at Kempstone Hill provides limited potential for foraging and commuting due to high levels of exposure.
F10	Fishermyre Wood South	Commuting and foraging, potential roost	Semi-natural broad-leaved woodland composed provides ideal foraging and commuting habitat of high potential value. The rest of the Habitat Area is composed of scrub and heath with limited commuting or foraging potential due to higher exposure levels. Due to access restrictions the interior of the woodland was not surveyed but along the road on the northern edge of the Habitat Area both foraging and commuting common and soprano pipistrelle were recorded. The farmhouse at Fishermyre is a potential roost (category 2a) however no bats were observed during the emergence survey.
F11	Fishermyre Wood North	Commuting and foraging	Mixed woodland with silver birch along the edges and scots pine plantation in the middle provides foraging and commuting with common pipistrelle identified along the B979.

Table 6 – Bat Activity Results for Section FL1

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[1]	Notes
NO 874 888	Megray Wood	Soprano Pipistrelle	5	C	Along road between woodland
NO 876 889	Limpet Burn	Soprano Pipistrelle	12	F	Following burn / valley in both directions
NO 878 888	Limpet Burn	Common + Soprano Pipistrelle	26	F	Following burn / valley in both directions. 18 Common / eight Soprano.
NO 879 888	Limpet Burn	Common Pipistrelle	6	F	Along valley
NO 880 888	Limpet Burn	Common Pipistrelle	15	F	Two bats, lots of passes, localised foraging.
NO 879 888	Limpet Burn	Common Pipistrelle	30+	F	Regular / constant foraging along burn in both directions.

[1] C= Commuting, F=Foraging, SC=Social Calling

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[1]	Notes
NO 879 888	Limpet Burn	Common Pipistrelle	6	F	Foraging in both directions.
NO 878 888	Limpet Burn	Common Pipistrelle	2	F	Single pipistrelle foraging around trees on edge, localised foraging.
NO 876 888	Limpet Burn	Common Pipistrelle	6	C/F	Two Commuting four Foraging west at ~2m
NO 875 888	Megray Wood	Common Pipistrelle	1	C	Flying east
NO 873 887	Megray Wood	Common Pipistrelle	3	C	One flying east, one flying west
NO 873 889	Road	Common Pipistrelle	1	F	Foraging east and west along road
NO 869 890	Shelterbelt, Megray Wood	Soprano Pipistrelle	1	C	Along shelterbelt at ~ 3m
NO 871 888	Shelterbelt, Megray Wood	Common Pipistrelle	2	C	Along shelterbelt at ~2m
NO 871 887	Shelterbelt, Megray Wood	Soprano Pipistrelle	1	C	Along shelterbelt
NO 871 884	Shelterbelt, Forester's Croft	Common Pipistrelle	3	F	At ride in shelterbelt where telewires cross. Flying at ~ 5m
NO 871 882	Shelterbelt	Common Pipistrelle	2	F	Around edges of shelterbelt ~ 2m
NO 871 881	Shelterbelt	Common Pipistrelle	2	C/F	Around edges of shelterbelt at ~ 2m
NO 871 880	Shelterbelt	Common Pipistrelle	2	F	In field on opposite side of shelterbelt from road flying at ~ 3m
NO 872 879	Polbare Belt	Common Pipistrelle	12	F	Foraging above road overhead at 4-5m
NO 872 876	Road	Common Pipistrelle	3	F	Two bats foraging over road at ~3m
NO 871 875	Road	Common Pipistrelle	3	F	Two bats foraging over road 2m
NO 874 879	Megray Burn	Common Pipistrelle	1	C	One bat flying south to north near top of wood along Megray Burn at ~ 3m
NO 877 876	Road	Common Pipistrelle	2	C	One bat commuting along road from farm 3-4m
NO 877 878	Hedgeline	Common Pipistrelle	1	F	One bat feeding along hedge
NO 874 885	Wood	Soprano Pipistrelle	7	F	Two bats feeding at edge of wood, overhead 3-4m
NO 871 891	Megray Burn	Common Pipistrelle	1	C	Along Megray Burn near woodland edge
NO 866 899	Tree lines	Common Pipistrelle	8	F	Tree lined lane

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[1]	Notes
NO 866 898	Tree lines	Common Pipistrelle	7	C	Tree line
NO 866 899	Tree lines	Common Pipistrelle	6	F/C	Tree lined road commuting both sides
NO 866 898	Tree lines	Common Pipistrelle	1	C	Tree lined road
NO 866 899	Tree lines	Soprano Pipistrelle	7	F	Tree lined route
NO 867 899	Tree lines	Soprano + Common Pipistrelle	9	C/F	Along both sides of tree lined road
NO 869 903	Scrub lined road	Soprano Pipistrelle	1	F	Along road
NO 867 900	Shelterbelt	Common Pipistrelle	3	F	Two bats foraging
NO 866 901	Road	Common Pipistrelle	1	C	Along road
NO 864 903	Road	Common Pipistrelle	1	C	Along road
NO 866 899	Road	Common Pipistrelle	1	C	Along road

Section FL2

3.2.14 This section is characterised by large areas of open farmland with limited foraging value to bats – with a network of field boundaries composed of stone dykes and drains which have some commuting potential. Gorse and tree lined tracks and roads also provide commuting routes throughout. A large area of open heath in the southwest corner has limited foraging value due to its exposure. However, the edge habitats provide very good foraging and commuting habitats in the form of scrub, mixed woodland and willow scrub. The most concentrated area of bat activity was around the Burn of Muchalls and associated riparian habitat which runs across the width of the corridor, connecting habitats and potential roosts sites on either side of the study area.

3.2.15 Eight buildings were identified as roosts during daytime and evening surveys. A further 11 buildings were identified as potential roosts (category 2a) during day surveys. One culvert was identified as having high roost potential with another culvert identified as a roost just outside the study area over a drain which runs through one of the Habitat Areas. Four sites for potential tree roosts were identified including several trees along the Burn of Muchalls.

3.2.16 A total of 204+ bat passes were recorded. Of these passes, 135 were foraging bat passes, 15 were commuting bat passes and 25 were foraging/commuting passes from common and soprano pipistrelle. At least 16 Daubenton's bat foraging passes were recorded with a further 18 foraging passes attributed to a combination of common pipistrelle and Daubenton's bats. Commuting routes were identified along the edge of the woodland habitat beside the B979, along the length of the Burn of Muchalls, between Elrick and the Burn of Muchalls, along the drain to the north of Clayfolds and along the access track running south from Cookney. Foraging areas were identified along the road between Fishermyre and the Burn of Muchalls (particularly in association with buildings and their garden) along the length of the Burn of Muchalls, along the track between Elrick and the Burn of Muchalls and along the access track running south from Cookney (also often in association with buildings and garden planting).

3.2.17 The results from Section FL2 are shown in Table 7, Table 8 and Figures 40.4b-d and 40.5b-d.

Table 7 – Specific Features Within Section FL2

Habitat Area	Feature	Feature Type	Description / Additional information
F12	Fishermyre Wood. Wet habitats to the south of Allochie Croft	Foraging and commuting	The area is dominated by dry heath around the edges of the Habitat Area, providing medium potential foraging habitat but with moderate exposure levels. Scrub borders the northwest and southeast edges and mixed semi-natural woodland is present towards the southwest. There are also scattered pockets of willow-dominated wet woodland ranging across the south which provide sheltered high value foraging and commuting habitats. Soprano pipistrelles were identified foraging along the gorse lined road to the south of the Habitat Area and pipistrelle spp. were recorded foraging and commuting along the same southern edge on a separate evening. Common pipistrelle were recorded on the B979 commuting along the tree line of the mixed woodland. This provides connectivity with the Habitat Areas further south as per F6, F5 and F2.
F13	Agricultural fields surrounding Hill of Muchalls	One roost, foraging and commuting, potential roosts	This area is comprised of agricultural land that is predominantly improved grassland or grasses cropped for silage and of low value to foraging and commuting bats. However small areas of mature mixed plantation woodland and shelter belts throughout and occasional patches of dense gorse scrub provide medium potential for commuting and foraging. Foraging common and soprano pipistrelle were recorded around the properties and gardens of Broomhill cottage, Strathgyle Cottage and Hillside/ Woodview. Commuting pipistrelle sp. were recorded along a dyke lined track between the cottages at Woodview and the Back Burn. One tree in the garden of Broomhill cottage was identified as a potential tree roost (category 2a). A culvert/bridge over Back Burn has high roosting potential due to its location along a watercourse and a number of suitable gaps and cracks. The burn flows north into the Burn of Muchalls (F15) which is a valuable roosting, commuting and foraging resource. Three buildings were identified as category 2a potential roosts and two buildings were identified as category 2b potential roosts. All of the 2a category buildings were surveyed in the evening but no bats were observed emerging. One historic roost was identified at Woodview during a day survey but no bats were observed during the emergence survey.
F14	Heath by Allochie	Potential foraging and commuting	A small area of heathland that has not yet been grubbed up for agriculture provides foraging potential of medium value with medium potential commuting along the track on the southern edge.

Habitat Area	Feature	Feature Type	Description / Additional information
F15	Burn of Muchalls	Two roosts, foraging, commuting and potential tree roosts	Varied riparian habitat surrounding the Burn of Muchalls includes semi-natural wet woodland in the eastern section with young mixed plantation woodland in the western. Within the western area there are also two ponds surrounded by trees providing ideal sheltered foraging. Foraging and commuting Daubenton's bats, and common and soprano pipistrelle were recorded along the length of this habitat: over the burn, within the woodlands and over the ponds. The burn provides a linear feature connecting habitats on either side of the corridor with high levels of freshwater invertebrate prey as well as insects associated with the woodland habitats. Several trees within this area provide medium to high potential for roosting. A soprano pipistrelle roost was identified in the farmhouse at Burnside and an outbuilding at Burnorrachie Croft has been used as a roost for approximately ten years although the owners have not seen the bats this year. During the day survey evidence indicated recent use (category 1B) however an evening survey has not been carried out and is required during the2007 surveys.
F16	Agricultural fields from north of the Burn of Muchalls to Cookney	Five building roosts, one roost in culvert, foraging, commuting, potential building and tree roosts	This Habitat Area is predominantly agricultural land consisting of improved pasture and cropped silage with low potential to foraging and commuting bats. The management of the area has however been sympathetic and there are many newly planted hedgerows and shelterbelts and groups of mature trees including Scots pine and beech. At present the new planting provides commuting routes of medium potential however with time they will be of high foraging and commuting potential. Field boundaries are predominantly stone dykes which provide linear features with potential to commuting bats. Common pipistrelle were recorded foraging and commuting along the Burn of Blackbutts and an area of willow scrub/ bog adjoining this has high foraging potential. The culvert over this drain, just beyond the edge of the habitat area to the east/ just outside the study area was identified as a roost for Daubenton's bats due to the presence of droppings under a crack in the stonework. Foraging and commuting common and soprano pipistrelle were also recorded on the track between Elrick and the Burn of Muchalls and foraging common pipistrelles were recorded on the tree lined track to the south of Cookney as far as Cairnlea and the track leading south from here, along the western edge of the habitat area was identified as a foraging and commuting route used by common pipistrelle. Trees within the garden at Elrick were identified as having high roosting potential (category 2a) and foraging pipistrelles were recorded in this area. A mature pollarded tree behind the war memorial in Cookney has a large split in it providing a potential bat roost (category 2a). Cookney Grange and one of the barns at Elrick were identified as roosts for soprano pipistrelle, with both common and soprano pipistrelle recorded foraging in the grounds along the tree/ hedge line. Elrick may also be a Brown long-eared bat roost. Buildings identified as roosts during day surveys, with evidence of recent use (category 1b) include one of the farmhouses at Cookney Mains, Kirkton and Cairnlea (although no bats were observed emerging during an emergence survey). Potential roosts in this area include Elrick farmhouse, Clayfolds, the newly built house to the south of Clayfolds (which has entry holes specially incorporated in the eaves for bats), Burnorrachie, Kirkhill Cottage, Floors and North Cookney (all category 2a). North Cookney was surveyed in the evening but no bats were observed emerging.

Table 8 - Bat Activity Results for Section FL2

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[2]	Notes
NO 872 913	Hillside	Common Pipistrelle	10	F	Foraging around garden with trees, stopped after 1.5 mins.
NO 875 918	Burn of Muchalls	Common Pipistrelle	7	F	Circling around mature trees on driveway and corner of road at bridge. Up and down burn
NO 872 910	Broomhill Cottage	Common Pipistrelle	1	F	In garden from corner of cottage to tree and back behind cottage.
NO 869 906	Gorse scrub	Unknown	1	F	Above gorse scrub at ~3m
NO 871 920	Tree lined track	Common Pipistrelle	5	C/F	Two bats commuting, three bats foraging
NO 871 919	Tree lined track	Common Pipistrelle	2	F	Along track from direction of house
NO 869 920	Track	Common Pipistrelle	1	C	Flying southeast along track
NO 872 919	Burn of Muchalls	Soprano Pipistrelle ?	1	C	Picked up on bat detector but not seen
NO 873 919	Burn of Muchalls	Common Pipistrelle	6	F/C	Three foraging west, one localised foraging, one commuting to east and one commuting to west
NO 874 918	Burn of Muchalls	Common Pipistrelle	1	F	Flying southwest along burn
NO 875 917	Burn of Muchalls	Common Pipistrelle	1	C	Flying west
NO 875 922	Field Boundary	Common Pipistrelle	3	F	Flying southwest
NO 878 925	Field Boundary	Common Pipistrelle	1	C	Along field boundary
NO 876 926	Field Boundary	Common Pipistrelle	5	F	Flying northwest along field boundary
NO 872 921	Elrick	Soprano Pipistrelle	3	C	Flying south
NO 870 919	Pond	Daubenton's	15	F	Over pond
NO 869 920	Pond	Common Pipistrelle	1	F	Alongside pond
NO 868 921	Pond	Common Pipistrelle	5	F	Beside pond localised foraging
NO 872 919	Burn of Muchalls	Common Pipistrelle	1	C	east along field boundary

[2] C= Commuting, F=Foraging, SC=Social Calling

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[2]	Notes
NO 872 919	Pond	Daubenton's	1	F?	Just after rain stopped
NO 871 919	Tree line	Common Pipistrelle	14	F/C	Seven foraging, seven commuting east along tree line and burn at 2-3m
NO 870 919	Pond	Common Pipistrelle + Daubenton's	18	F	Along pond length 0.5-2.5m
NO 869 920	Pond	Common Pipistrelle	8	F	End of pond/trees
NO 868 920	Track	Soprano Pipistrelle	5	C	Following track
NO 870 919	Pond	Soprano + Common Pipistrelle	16	F	Along vegetation at edge of pond ~2m, probably just one pip.
NO 870 919	Pond	Common Pipistrelle	28	F	Along vegetation at edge of pond ~2m
NO 872 919	Burn of Muchalls	Common Pipistrelle	2	C	Flying east to west
NO 870 932	Track	Common Pipistrelle	6	F	Following track south, southwest to north, northeast
NO 870 931	Track	Common Pipistrelle	24	F	Up + down track between row of trees (on either side)
NO 869 930	Track	Common Pipistrelle	10	F	Along track and in garden ~3m
NO 870 932	Track	Common Pipistrelle	7	F	Following track

Section FL3

3.2.18 This section is characterised by large areas of open farmland of limited foraging value to bats with a network of field boundaries composed of stone dykes, gorse scrub and drains which provide some commuting potential. Gorse and tree lined tracks and roads also provide potential commuting routes throughout. Areas of scattered gorse and willow scrub, coniferous plantation and heath provide medium to high foraging potential and good commuting potential along their edges.

3.2.19 The buildings, gardens and hedge-lined road at Cookney are of high value to foraging bats, especially as the buildings and trees provide shelter on the otherwise exposed hill. Crynoch Burn and associated riparian habitat in the northwest also represent a high value foraging area and an ideal corridor connecting habitats and potential roost sites upstream, downstream and beyond the boundary of the study area, including Kingcausie and the River Dee. Foraging and commuting bats (predominantly soprano pipistrelles) were recorded along the majority of its length. Foraging and commuting activity was also recorded along several tree and scrub lined tracks throughout the section, often associated with identified and potential building roosts, e.g. along the track running north from North Cookney Croft to West Stoneyhill and West Town of Stoneyhill, beside North Rothnick and along the tree lined road to the south of Burnhead where a Natterer's bat was also recorded. High levels of foraging activity recorded at North Rothnick may indicate the presence of a roost at the farm. This site has been identified as having roost potential (category 2a), but requires an evening emergence survey. Similarly, high levels of foraging activity around Burnhead may indicate the presence of one or more roosts either at Burnhead or nearby. The presence of mature trees and gardens associated with the houses and the number of linear features connecting with

the surrounding area also increases the value of this semi-urban habitat. Crossley Pond is sheltered by trees and provides high value foraging on the edge of the survey corridor where small numbers of Daubenton's bats were recorded. Additional foraging activity was also recorded during emergence surveys around the houses and gardens at Cookney, North Cookney Croft, Crossley and Altries Manse.

3.2.20 A high potential commuting route follows the tree lined road between Altries Manse (where a roost has been identified) and Craigentath. However, a commuting route survey to establish its value is necessary during 2007. The levels of activity recorded are more likely a reflection of the number of activity surveys carried out in the area as a result of access restrictions rather than low bat numbers as there are several areas with potential for foraging and commuting bats thathave not been surveyed (refer to Section 2.6).

3.2.21 Seven buildings were identified as roosts during daytime and evening surveys, with five of these confirmed by emergence surveys. A further 20 buildings were identified as potential roosts during day surveys (eight category 2a and nine category 2b), although only four of these have had emergence surveys carried out to confirm their use. Five buildings at Burnhead and one building at Harecraig were not surveyed due to access restrictions and require surveying in 2007. Two culverts were identified as having medium roost potential.

3.2.22 A total of 202+ bat passes were recorded. Of these passes, 178+ were foraging bat passes (including three also making social calls), seven were commuting bat passes and four were commuting/foraging passes attributed to common and soprano pipistrelle. One foraging pass was recorded for Daubenton's bat and nine Natterer's bat foraging passes were recorded. Commuting routes were identified along the edge of the road to the south of Crossley and along Crynoch Burn. Foraging areas were identified along the tree lined road between Burnhead and Craigentath, along the tree lined track running east from West Stoneyhill, around the houses and vegetation at Burnhead, North Rothnick, Crossley and Altries Manse, along Crynoch Burn and over the water-filled quarry to the west of Crossley. A potential commuting route is also identified along the road to the north of Altries Manse.

3.2.23 The results from Section FL3 are shown in Table 9, Table 10 and Figures 40.4d-f and 40.5d-f.

Table 9 – Specific Features Within Section FL3

Habitat Area	Feature	Feature Type	Description / Additional information
F17	Wet habitats north of Cookney	Two roosts, foraging, commuting and potential roosts	This Habitat Area consists of the village of Cookney, coniferous and broadleaved shelterbelts, rough grazing with scattered scrub and an area with patches of bog, wet and dry heath. The area of grazing and scrub to the north of Cookney is bounded by a line of broadleaved trees and a stone dyke. Foraging and commuting common and soprano pipistrelles were recorded along the length of this treeline. The area of rough grazing and scrub has medium-high potential for foraging due to its sheltered nature. However, the area of heath has lower potential foraging and commuting value due to higher exposure. Common pipistrelle roosts were identified in one of the barns at Mains of Cookney and at Hillend in Cookney. Two potential roosts (category 2a) were also identified at R.U.M House (the original church) and a newer barn beside R.U.M House. These potential roosts were surveyed in the evening but no bats were observed emerging. Foraging common and soprano pipistrelle were recorded around all of the buildings, along the road and hedge lines during the emergence surveys. This Habitat Area is closely linked to the bat roosts in F16 where alternative bat roosts were identified.

Habitat Area	Feature	Feature Type	Description / Additional information
F18	Agricultural fields from Cookney to East Rothnick Wood	One roost, foraging, commuting, potential building and culvert roosts	Large area of predominantly improved grassland, occasional arable fields and scarce marshy grassland provide limited foraging or commuting potential for bats due to low insect abundance and high exposure levels. Field boundaries composed of stone dykes, scrub and drainage channels provide some linear features of medium commuting potential through this otherwise low value habitat. Scrub and tree lined tracks towards the southern end of the habitat area provide good foraging and commuting with common pipistrelle recorded in several places along the track between North Cookney Croft , West Stoneyhill and the road adjacent to West Town of Newhall. The line of mature beech trees along the track at West Town of Newhall has good potential for tree roosts (category 2a) and a commuting common pipistrelle was recorded on this stretch of the track. Pockets of scrub throughout the area provide some foraging and commuting potential, but only where connected with other habitats of greater potential for foraging, commuting or roosting. Soprano pipistrelle were recorded foraging and commuting along the gorse lined track beside North Rothnick Farm. The owner of South Rothnick farm reports that there is bat activity around the property in the evenings. A culvert with medium roosting potential was identified beneath the track to the north of South Rothnick. One common pipistrelle roost was identified at North Cookney croft. Five potential roost sites (category 2a) were identified at Stoneyhill, West Stoneyhill, South Rothnick, North Rothnick and East Rothnick. Of these only Stoneyhill has been surveyed in the evening but no bats were observed emerging although constant foraging activity was recorded along the tree lined path during the survey (common pipistrelle).
F19	Stoneyhill	Potential roost, foraging, commuting	Willow and gorse scrub to the north of Harecraig provides high foraging and commuting potential. Smaller areas of rough pasture are of low potential to foraging and commuting bats. One building in the Habitat Area was not surveyed due to lack of access permission and requires survey during 2007. The other buildings were not found to have any roost potential.
F20	Agricultural Fields around Berrytop	Foraging, potential commuting and potential building roosts	Only part of this Habitat Area is within the study area . It consists of a series of agricultural fields with occasional pockets of scattered scrub, notably within the vicinity of both new and established dwelling houses. The area is open and exposed with low foraging and commuting potential with the exception of the road which forms the northern boundary to the Habitat Area. Foraging soprano pipistrelle and Daubenton's were recorded over Crossley Pond, just outside the corridor to the west. These bats could potentially have been commuting along the scrub lined road to roost sites within this section, e.g. F21. The three new buildings within this Habitat Area were not surveyed due to lack of access permission and require future surveys. Activity surveys along the road did not reveal any bats.

Habitat Area	Feature	Feature Type	Description / Additional information
F21	Wet habitats around East Crossley	Two roosts, foraging, commuting and potential roost	The habitats in this area range from soft, rush-dominated, sheep-grazed fields in the north to richer dry heath/acid grassland mosaic with scattered scrub. The potential foraging value of this area is medium due to a lack of shelter and linear features, with low commuting potential. There are mature trees in the gardens around the three houses at Crossley and common and soprano pipistrelle were observed foraging in this area during emergence surveys. Commuting soprano pipistrelles were recorded along the road on the edge of the habitat area in the north. Crossley Farm Steading is an identified common pipistrelle roost. Crossley is a roost identified during day surveys although no bats were observed emerging during the evening survey. One potential roost at Rothnick Croft (category 2a) was not subject to an emergence survey in 2006.
F22	Agricultural fields from Quoscies to Stranog	One roost, foraging and potential commuting	A series of improved fields with soft rush are prominent in the mid-section and scattered and dense gorse scrub is found throughout the north. The foraging and commuting potential for the northern area is medium with lower potential in the open, grazed southern section. Commuting bats could potentially be using the scrub habitat in conjunction with or to connect with the quarry pond to the west of F20 where foraging Daubenton's and soprano pipistrelle were recorded, although activity surveys did not confirm potential commuting or foraging activity. One common pipistrelle roost was identified at Altries Manse on the northern edge of the Habitat Area. Foraging activity was recorded within the garden around the mature trees during the emergence survey.
F23	Dry heath/acid Grassland mosaic to the west of Wedderhill	Potential foraging and commuting	Dry heath/ acid grassland mosaic with scattered scrub and patches of wet heath leading onto bog provides medium foraging and commuting potential around the edges. The lack of shelter in the middle of this exposed area, in addition to limited linear features of note for commuting, reduces its potential value here.
F24	Bog/heath to the immediate west of Wedderhill	Potential foraging and commuting	Wet modified bog is the dominant habitat with areas of dry heath, wet birch woods and scattered broadleaved trees and mature Scots pine. A small vegetated burn is present with a pool of standing water. This area provides high potential foraging and medium potential commuting habitat along the woodland edges and roadside. There are no trees or buildings with roost potential within the area.
F25	Plantation Woodland south of Stranog	Potential commuting	Very young coniferous plantation woodland providing low value to foraging bats and medium potential to commuting bats around the edges. Bats leaving the roost at Altries Manse (F22) could be commuting along this plantation edge /the road towards an area of open oak woodland beyond the east edge of the study area. Commuting route surveys are required to confirm the use of this road and tree line as a commuting route.

Habitat Area	Feature	Feature Type	Description / Additional information
F26	Agricultural fields to the south of Polston Farm	One roost, foraging, commuting and potential roosts	Dominated by improved fields, scrub is rare, but marshy grassland is present to the west of Burnhead. Gorse lined field boundaries and coniferous shelterbelts in the southern section, beside Greens of Crynoch provide good potential commuting routes between roosts and habitat areas to the south and Crynoch Burn in F27. Foraging common and soprano pipistrelle were recorded in the northeastern portion of the Habitat Area, around the houses and gardens at Burnhead and along the treelined road running south from Burnhead. This road connects with Craigentath Wood which lies just outside the Habitat Area and is composed of open, mature oak woodland with high foraging, roosting and commuting potential. One stone culvert under the road in the southern part of the Habitat Area is of medium roosting potential. One roost identified during days surveys (category 1b) in one of the old barns at Greens of Crynoch. Eight potential roosts (category 2b) at Broomhill, Burnhead and Craigentath (which is just outside the habitat area but still within the study area). Five buildings at Burnhead were not surveyed during the day during 2006 and may have roosting potential. Day and potentially evening surveys will be carried out on these buildings during 2007.
F27	Floodplain and Immediate surrounds of Crynoch Burn (south)	Foraging, commuting	Semi-improved grassland dominates the south of this Habitat Area, giving way to improved fields with abundant gorse scrub. Crynoch Burn and associated riparian habitat provides ideal foraging and commuting of high value, with common and soprano pipistrelle recorded along the northern end of this Habitat Area. Activity surveys were not carried out in the southern part of the Habitat Area due to the presence of horses and livestock however, the burn has high potential for foraging and commuting and is likely to be used by a number of bats as per Appendix A25.3 S19 and S22. It provides a valuable linear feature connecting habitats in the south and the high foraging value areas of river, riparian habitat and woodland including Kingcausie to the north.

Table 10 – Bat Activity Results for Section FL3

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[3]	Notes
NO 871 933	Road	Common Pipistrelle	25	F	Along road between trees
NO 873 934	Treelined road	Soprano Pipistrelle	5	F	Following tree lined road.
NO 871 936	Road with scrub	Common Pipistrelle	2	F	Fling south to north along road, in scrub on sides
NO 871 939	Road	Common Pipistrelle	3	F	Following road
NO 869 942	Track	Common Pipistrelle	3	F	East to west following track
NO 873 942	Garden and track	Common Pipistrelle	3	F	Around garden and track
NO 866 963	Pond	Daubenton's	1	F	Around pond

[3] C= Commuting, F=Foraging, SC=Social Calling

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[3]	Notes
NO 866 963	Pond	Soprano Pipistrelle	3	F	Along road near trees / near trees by pond
NO 870 956	Tree line, Rothnick croft	Common Pipistrelle	2	C+F	Foraging along road by Rothnick croft, commuting from east to west in tree-line
NO 873 954	Track, N. Rothnick barn	Soprano Pipistrelle	1	C	Near North Rothnick barn ~ 3m along access track toward main road
NO 872 954	N. Rothnick barn	Soprano Pipistrelle	30+	F	North Rothnick barn, continuous foraging around barn entrance
NO 872 954	Road, N. Rothnick barn	Common Pipistrelle	30+	F	Continuous foraging beside North Rothnick barn, next to road.
NO 874 955	Track	Soprano Pipistrelle	30+	F	Continuous foraging along access track, flying at 2-3m
NO 870 956	Track	Soprano Pipistrelle	3	F	Along track
NO 870 962	Road	Soprano Pipistrelle	1	C	Along road South to north at ~ 2m
NO 868 963	Road	Soprano Pipistrelle	1	C	North to south across road
NO 872 954	N. Rothnick barn	Soprano Pipistrelle	3	SC+F	In circles around front of barn
NO 874 985	Edge of field	Natterer's	9	F	Two Natterer's circling around trees and edge of field by road 2m
NO 863 985	Crynoch Burn	Soprano Pipistrelle	7	F	Foraging along burn
NO 864 984	Crynoch Burn	Soprano Pipistrelle / Common Pipistrelle	9	F	Following burn. Seven soprano and two common.
NO 865 985	Crynoch Burn	Common Pipistrelle	3	C	Flying west along burn
NO 865 984	Crynoch Burn	Soprano Pipistrelle / Common Pipistrelle	2	F/C	Flying southwest along burn

Grid Reference	Habitat	Species	Number of Bat Passes	Activity[3]	Notes
NO 864 983	Crynoch Burn	Soprano Pipistrelle	13	F	flying southwest along burn
NO 874 984	Crynoch Burn	Soprano Pipistrelle	1	F	Over burn
NO 875 980	Crynoch Burn	Soprano Pipistrelle	2	F	Flying at ~ 6m circling, and second bat round corner
NO 875 981	Crynoch Burn	Common Pipistrelle	1	F	Flying north at ~ 6m
NO 874 984	Crynoch Burn	Common Pipistrelle	4	F	Over burn
NO 873 984	Crynoch Burn	Common Pipistrelle	4	F	Over burn

3.3 Survey Results Summary

3.3.1 A number of features of value to bats have been identified within the study area between Stonehaven and Cleanhill. The study area is characterised by large areas of open arable and pastoral farmland with limited roosting and foraging opportunities. Smaller fragments of roosting, foraging and commuting habitat including burns, shelterbelts, woodlands, walls and buildings are interspersed within the study area.

3.3.2 The main areas of woodland within the study area are found at the southern Stonehaven end at Megray Wood and Fishermyre Wood. The B979 along the western edge of the study area is lined by a broadleaved shelterbelt and portions of woodland, the rest of which lie outwith the corridor. Riparian woodland exists at Megray Wood/ Limpet Burn and the Burn of Muchalls. The only larger area of coniferous plantation is to the south of Greens of Crynoch, which is still very immature.

3.3.3 Three main areas of open water and flowing water exist at Megray Wood/ Limpet Burn, the Burn of Muchalls and some of Crynoch Burn (which flows through the north of the study area). Other smaller burns and field drains are found throughout the study area.

3.3.4 Nineteen bat roosts were identified in buildings within the 1km survey area. Emergence surveys were carried out at New Mains of Ury farmhouse, a shed at New Mains of Ury, Woodview, Burnside, barn at Elrick, farm house at Mains of Cookney, Cookney Grange, Hillend, barn beside Cookney Grange, North Cookney Croft, East Crossley Steading, Number 2 Crossley and Altries Manse. Bats were not observed emerging from three of these during emergence surveys. Megray Farm Steading, Forester's Croft, Burnorrachie Croft, Cairnlea, Kirkton and a barn at Greens Crynoch were identified through day surveys and require evening surveys to identify the species present.

3.3.5 There are 38 buildings/properties with potential to be used as roosts (category 2a) of which 16 have had emergence surveys carried out, but no bats were observed emerging. Of the other potential roosts, 11 are category 2b roosts which do not require emergence surveys. Therefore, 14 buildings require emergence surveys during the 2007 survey period to determine if the buildings are being used as roosts. Eight properties have had no day or evening surveys carried out on them to establish their value to bats.

3.3.6 Five culverts have been identified as having medium potential for roosting and six sites have been identified as having trees with roost potential.

3.3.7 A total of 615+ bat passes were recorded across the study area. Of these passes, 471+ were foraging bat passes, 50 were commuting and 52 were foraging/commuting bat passes from

pipistrelle spp. 17+ Daubenton's bat foraging passes were recorded and nine Natterer's bat foraging passes were recorded. Section FL2 contains the greatest concentration of bat activity and the least was in Section FL3. Areas of activity were concentrated around woodland, watercourses/ features and the village of Cookney. Features of concentrated bat activity include Megray Wood (17 passes), Limpet Burn (100+ passes) the shelterbelt adjacent to the B979 (27 passes), around Fishermyre (62 passes plus activity recorded during emergence surveys), along the Burn of Muchalls and fish ponds (100+ passes) and Cookney (100+ passes). Small numbers of bats were observed foraging, commuting and displaying social activity in predictable areas away from these main areas.

3.3.8 Commuting routes where bat activity was observed between Habitat Areas: along linear features were identified along the tree line beside the B979, along Megray Burn and the track beside Megray Farm Steading, around the edges of Megray Woods, along Megray Burn and Limpet Burn, along the road beside Standingstones, along the road and track to the north of Strathgyle Cottage, along the Burn of Muchalls and along the tree lined track from Elrick to the Burn of Muchalls, along a tree lined field drain north of Elrick, along the tree lined road to the north of Cookney and along the tree lined track adjacent to West Town of Newhall.

3.3.9 The majority of observations were of soprano and common pipistrelle bats which are the commonest bats in the region, although brown long-eared bats were recorded at Elrick and Daubenton's bats were recorded over the Burn of Muchalls and at the water-filled quarry to the south of Crossley, on the study area boundary.

3.3.10 Potential commuting routes were also identified along the road beside Broomhill Cottage, along Back Burn, on the road south from Clayfolds to Burn of Muchalls, along the road between North Cookney and Bents Cottage, along the field drain to the north of South Rothnick, along the road south of Rothnick Croft and along the road between Altries Manse and Craigentath. These were not surveyed during 2006 in the evening to confirm their use by bats. This is being done during the 2007 survey period.

3.3.11 All potential habitats of high value to foraging bats were surveyed during night time activity surveys.

3.3.12 Daytime habitat assessment and evening emergence surveys revealed 16 roosts and many more potential roost sites in structures and trees within the study area . Despite a thorough assessment of trees, including a close examination of potential roost holes where these were accessible, few potential tree roosts were identified in proportion to the number of trees surveyed.

3.3.13 Four of the seven bat species known to be present in Aberdeenshire were observed during field surveys, exhibiting a range of behaviour including foraging, commuting and emerging from roosts. Bat activity was observed along the entire study area , with increased activity in certain predictable areas. Many landscape features such as tree-lined pathways and roads were used by common and soprano pipistrelle bats. Daubenton's bat activity was observed around water features and wet woodland areas and brown long eared bats were observed at Elrick, potentially using one of the barns as a roost.

3.3.14 Feeding behaviour was observed in specific and predictable areas including at woodland edges and over water features such as burns and lochs (Walsh, 1996a and 1996b). The lowest activity was observed in areas of high intensity arable agricultural land and industrial/residential areas with little vegetation and areas isolated from roost opportunities or linear habitat features.

4 Evaluation of Habitat Areas

4.1.1 The Habitat Areas that were identified have been evaluated in the context of their actual or potential value to bats. Habitat Areas have been evaluated according to whether the site is an actual or potential bat habitat (where R denotes roost or potential roost, C – commuting or potential commuting, F – foraging or potential for foraging). Where bats were observed using a feature within a Habitat Area, the importance of the area was assessed for each species recorded as present and, where bats were not present, the value of the habitat was assessed, using the evaluation of ecological receptor indicators and methods described in Section 2.4.

4.1.2 The proposed scheme runs predominantly through agricultural land managed for pasture and arable farming. Many of the woodlands within the survey area are coniferous plantation, which are both considered to be of low value to bats. Entwhistle et al (2001) note that whilst not providing good roosting opportunities, some coniferous woodland can provide high insect abundance and provide foraging habitat for species including pipistrelles and brown long-eared bats. However, there are a number of areas of suitable habitat including broadleaved woodland, tree lines and water features which are important because of their inherent value for bats seeking insect prey or roost sites. They are also important at a greater spatial scale due to their position and interconnection with habitats in the wider landscape. Each Habitat Area has been evaluated separately, but an overall summary value has been reached for each geographical section within the study area, according to its value to bats.

Section FL1

4.1.3 Of the 11 Habitat Areas in this section, one has been evaluated at less than local, nine of county and one of regional importance to bats. The relatively high proportion of Habitat Areas of county importance is a reflection on the fact that bats were observed using many of the features within this section including shelter belts, woodland and water features. Such features, that intrinsically support local populations of bats, are small and fragmented but widespread and considered to be of wider importance to bats roosting throughout the section. The presence of a number of small roosts for pipistrelle is important in maintaining the bat populations and reflects the regional importance of these features to bats, although the size of the roosts would not be considered as being of national importance for the species identified.

4.1.4 The evaluation of Habitat Areas in Section FL1 are shown in Table 11.

Table 11 – Evaluation of Habitat Areas in Section FL1

Habitat Area	Actual Activity	Potential Activity [4]	Evaluation	Comments
F1	n/a	C	County	Commuting routes appreciably enrich the county habitat resource by providing linear habitat connecting habitat areas including potential roosting area in Stonehaven.
F2	F	C, R	County	Mixed broadleaved shelter belt supports a population of internationally important species (common pipistrelle) that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F3	4R, F, C	R, F, C	Regional	Four building roosts at new Mains of Ury farmhouse and farm, Megray Farm Steading and Forester's Croft maintain small populations of internationally important species including common pipistrelle and soprano pipistrelle, which are not threatened or rare in the region or county.

[4] R=Roosts, F=Foraging, C=Commuting

Habitat Area	Actual Activity	Potential Activity [4]	Evaluation	Comments
F4	n/a	C	County	Site in combination with F3 supports populations of internationally important species (common pipistrelle) that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F5	C	F, R	County	Mixed broadleaved shelter belt supports a population of internationally important species including common and soprano pipistrelle that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F6	F, C	R	County	Site – in combination with more species-rich, valuable habitat in F7 – supports a population of internationally important species including common pipistrelle that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F7	F, C	R	County	Megray Burn and associated habitats appreciably enrich the county habitat resource by providing linear habitat connecting potential roosting sites and high value foraging. The area supports a population of internationally important species including common and soprano pipistrelle that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F8	C	R	County	Due to the presence of three identified potential roosts and two un-surveyed buildings which may have roost potential this area is of county importance. However should any roosts be confirmed then this evaluation will change to regional.
F9	n/a	n/a	Less than local	Exposed hillside with very little surrounding habitat of value to bats and limited ecological importance due to lack of foraging, commuting or roosting opportunities. These are provided by woodlands within the nearby F7 and F10.
F10	C, F	R	County	The area supports a population of internationally important species including common and soprano pipistrelle that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F11	C,F	n/a	County	The area supports a population of internationally important species including common pipistrelle that are not threatened or rare in the region or county, and is not integral to maintaining those populations.

Section FL2

4.1.5 Of the five Habitat Areas in this section, one has been evaluated at local, one of county and three of regional importance to bats. The relatively high proportion of Habitat Areas of regional importance is a result of the number of identified roosts recorded. The Burn of Muchalls in particular provides a high value habitat which is likely to support bats roosting in the area. The presence of a number of small roosts for pipistrelle is important in maintaining the bat populations and reflects the regional importance of these features to bats, although the size of the roosts would not be considered as being of national importance for the relevant species population.

4.1.6 The evaluation of Habitat Areas in Section FL2 is shown in Table 12.

Table 12 – Evaluation of Habitat Areas in Section FL2

Habitat Area	Actual Activity	Potential activity [5]	Evaluation	Comments
F12	F, C		County	The scrub and tree lined edges of this heath habitat supports a population of internationally important species including common and soprano pipistrelle that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F13	1R, F, C	R	Regional	The roost at Woodview maintains populations of internationally important species that are not threatened or rare in the region or county. Until an evening emergence survey is carried out to identify the species present this has been given a regional evaluation which could potentially increase to national if the species identified were rare.
F14	n/a	F, C	Local	Heath habitat and linear features around and within it considered to appreciably enrich the habitat resource within the local context.
F15	2R, F, C	R	Regional	The roosts at Burnorrachie Croft and Burnside maintain a small population of internationally important species (soprano pipistrelle) that are not threatened or rare in the region or county.
F16	6R, F, C	R	Regional	The roosts at Cookney Grange and Elrick maintain small populations of internationally important species (soprano pipistrelle and potentially brown long-eared bats) that are not threatened or rare in the region or county. The culvert maintains a small population of Daubenton's bats. Until an evening emergence survey is carried out to identify the species present in the other roosts (Mains of Cookney, Kirkton, Cairnlea) these are assumed to be of regional value which could potentially increase to national if the species identified were rare.

Section FL3

4.1.7 Of the 11 Habitat Areas in this section, three are considered to be of local importance, three of county importance and five of regional importance. The relatively high proportion of Habitat Areas of county importance is a reflection on the fact that bats were observed using many of the features within this section including shelter belts, woodland and water features. Such features, which intrinsically support local populations of bats, are small and fragmented but widespread and considered to be of wider importance to bats roosting throughout the section. The presence of a number of small roosts for pipistrelle is important in maintaining the bat populations and reflects the regional importance of these features to bats, although the size of the roosts would not be considered as being of national importance for the species identified.

4.1.8 The evaluation of Habitat Areas in Section FL3 is shown in Table 13.

[5] R=Roosts, F=Foraging, C=Commuting

Table 13 – Evaluation of Habitat Areas in Section FL3

Habitat Area	Actual Activity	Potential Activity [6]	Evaluation	Comments
F17	2R, F, C	R	Regional	The roosts at Hillend and in one of the barns at Mains of Cookney maintain populations of an internationally important species (common pipistrelle) that are not threatened or rare in the region or county.
F18	R, F, C	R	Regional	The roost at North Cookney Croft, in the southern part of this Habitat Area, maintains populations of an internationally important species (common pipistrelle) that are not threatened or rare in the region or county.
F19	n/a	R, F, C	County	One building in the area was not in 2006 surveyed and based on a precautionary principle it could potentially be a roost. If surveys revealed its use as a roost the evaluation would be upgraded. As a potential roost, the area supports a population of an internationally important species that is not threatened or rare in the region or county, and is not integral to maintaining those populations.
F20	F	C,R	County	Area including Crossley Pond and potential roosts just outside the study area supports a population of internationally important species that are not threatened or rare in the region or county, and is not integral to maintaining those populations.
F21	2R, F, C	R	Regional	Roosts at Crossley and Crossley Farm Steading support populations of internationally important species (pipistrelle sp.) that are not threatened or rare in the region or county, and are not integral to maintaining those populations.
F22	R, F	C	Regional	Altries Manse supports a population of internationally important species (common pipistrelle) that is not threatened or rare in the region or county, and is not integral to maintaining those populations
F23	n/a	F, C	Local	Area retains habitat considered to appreciably enrich the habitat resource within the local context by connecting higher value habitats.
F24	n/a	F, C	Local	Area retains habitat considered to appreciably enrich the habitat resource within the local context by connecting higher value habitats inside and outside the study area .
F25	n/a	C	Local	Area retains habitat considered to appreciably enrich the habitat resource within the local context by connecting higher value habitats inside and outside the study area .
F26	R, F	R	Regional	An old barn at Greens of Crynoch supports a population of internationally important species (roost identified during the day only so species unknown) that is not threatened or rare in the region or county, and is not integral to maintaining those populations.
F27	F, C	n/a	County	Commuting and foraging route supports a population of internationally important species that is not threatened or rare in the region or county, and is not integral to maintaining those populations

Evaluation Summary

4.1.9 Over the whole of the study area, one Habitat Area was considered to be of less than local, four of local, 13 of county and nine of regional importance. All of the Habitat Areas considered to be of regional value are bat roosts which maintain populations of internationally important species. The

[6] R=Roosts, F=Foraging, C=Commuting

dominance of county important Habitat Areas reflects the fact that most resources within the study area with the potential to support foraging or commuting bats were observed being used by bats during evening surveys. Due to the presence of only small numbers of bats in such areas these were not considered to be of higher value. Where bats were not observed using Habitat Areas, but where the resources provide habitat of potential value to bats (for example due to their size or in terms of the foraging resource or shelter they provide), the Habitat Areas are considered to be of local ecological value importance that they provide. The one area of less than local importance to bats was considered to lack any significant resources suitable for roosting, foraging or commuting.

4.1.10 All three geographical sections within the study area are considered to be of value due to the size, quality and nature of habitats they provide and the number of bats observed. Similar numbers of bats were recorded within each section although the number of identified and potential roosts is highest in Section FL1. This section however is not considered to be of higher than regional value due to the fragmented nature of the habitats in the area and the small size of roosts identified.

5 Potential Impacts

5.1 Introduction

5.1.1 The following assessment addresses the potential impacts (in the absence of mitigation) on bats, their roosts, feeding habitat, reproduction and behaviour associated with both the construction and operational phases of the proposed scheme (both short and long-term).

5.1.2 There are a number of different types of impact associated with road schemes and DMRB outlines potential impacts resulting from roads and bridges (DMRB, 2001). These guidelines outline the possible effects road development may have on bats and bat populations, including the following:

- direct habitat loss through land-take including loss of roost and foraging areas;
- severance of habitat features including habitat fragmentation, isolation and severance of connectivity between habitat fragments;
- road traffic related mortality (RTA);
- disruption to local hydrology and associated degradation of wetland foraging areas;
- polluted runoff;
- effects of road lighting; and
- habitat creation.

5.1.3 Potential impacts that would occur as a result of the proposed scheme vary in their effects on bat populations depending on the size of the population and the scale, extent and persistent nature of the impact. In general, impacts that affect the number, distribution and suitability of roost opportunities and those that influence the availability of insect prey can be expected to have impacts on the behaviour and viability of bat populations within the route corridor. The size of the roost or population to be affected will also affect the significance of the impact. The main impacts are those which involve the destruction of roosts and direct bat mortality. This is exacerbated by the relatively low availability of alternative roost sites around the landscape and the disproportionately large impact on bat populations a small number of displacements or deaths might have on bat communities in the area.

5.1.4 The impacts associated with the operational phase of the scheme are considered to be permanent, whereas temporary impacts, which are only apparent while the road is being built, are discussed in association with the construction phase. In addition, it is important to recognise that the potential generic impacts outlined below frequently interact (i.e. habitat loss during construction can potentially result in disturbance and habitat fragmentation) and the resulting combination of impacts may, through synergistic effects, significantly increase the adverse impacts of the proposed scheme (Luell et al 2003).

5.1.5 The specific impacts of road construction and operation vary in their significance in relation to the area of the habitat or feature impacted. While the loss and severance of woodland corners, edges and tree lines may represent only a small area of habitat, the implications for bats using these areas could be disproportionately large.

5.2 General

5.2.1 The potential impacts that would be likely to result from the proposed scheme have been identified and are described below for construction or operation. Where cumulative effects require consideration, this has been assessed separately (see Part E: Cumulative Assessment, of the ES).

Direct Mortality

5.2.2 Bats are relatively long-lived, take several years to reach reproductive maturity and then produce only one offspring a year. They therefore invest a lot of energy into producing relatively few young compared with other similar-sized terrestrial mammals making bat populations particularly susceptible to impacts that compromise their numbers or ability to reproduce (Kunz, 1982).

Construction

5.2.3 There is a high risk of mortality if bats are roosting in any structure or tree to be demolished or felled. As discussed above this might have impacts on bat populations and confers an additional risk of prosecution if bats are killed or roosts destroyed, as bats and their resting places are protected by law (see Section 1.2).

Operation

5.2.4 There is a risk of road traffic accidents (RTA) caused by collision with oncoming vehicles. The predicted risk is generally low as bats are unlikely to be attracted to major roads (DMRB, 2001). However, the risk would increase where the proposed road severs flight lines and where young bats are emerging from maternity colonies as these are particularly weak fliers. It has been estimated that between 1 and 5% of bats die as a result of traffic accidents (Limpens et al 2005). The problem is exacerbated by the fact that most of the bat species present in Aberdeenshire fly relatively low above the ground when commuting (Bach and Limpens, 2004).

5.2.5 Highway projects can cause bat traffic casualties for a number of reasons including severance of a bat commuting route either directly or indirectly (e.g. road lighting). Placement of a new road close to a roost /roosts may encourage bats to use new features parallel with the route as new flightlines. Air turbulence caused by fast and large road traffic is though to suck nearby bats into the path of oncoming vehicles. Lighting can encourage some species (e.g. noctules, pipistrelles and Leisler's bats) to forage close to highways as prey is attracted to roadside lighting. It is though that juveniles may be at greater risk due to their inexperience (Highways Agency, 2005).

Habitat Loss

5.2.6 Bats are particularly sensitive to habitat loss, and even small patches of habitat may have wide-ranging implications for the bats that use them (DMRB, 2001). High roost fidelity and roost selectivity in certain species (e.g. brown long-eared bats; Entwistle et al 1997) mean that loss of roost sites may be detrimental to the populations using them. In particular this may be manifested by the selection of sub-optimal roost sites which may influence survival rates, especially at sensitive times of year including during hibernation or breeding. Optimal habitats including broadleaved woodland, habitat corridors and lacustrine/riverine habitats are relatively rare and their distribution scattered (Walsh et al 1996a and b) and bat populations are likely to be susceptible to changes in resource availability. Although the habitat lost may recover in the medium to long term, following the construction period the quality of the habitat may be reduced, especially if the connectivity between remaining patches is also compromised.

5.2.7 Bats use linear features such as rivers, hedgerows and treelines as commuting routes between roosts and foraging grounds (Limpens and Kapetyn, 1991). The integrity of these habitat features is often critical to the continued viability of bat populations as bats need to be able to move freely between them (Mitchell-Jones and McLeish, 1999). Therefore, small scale modifications to such features, for example as a result of development, must be taken into consideration when predicting the impacts of a development (Warren et al 2000) as per impacts of direct mortality and fragmentation.

Construction

5.2.8 In the short to medium term habitat loss would be manifested through land-take for the siting of compounds, access roads and other construction activities, although the loss of roosts is also considered to be a construction impact as it has an immediate and permanent impact on using the roosting. The locations of construction compounds are not known, but the impact assessment identifies potential habitat loss impacts that could be expected due to general construction activities.

Operation

5.2.9 Permanent habitat loss would be caused by the permanent road structure and associated embankments, cuttings and slip roads. The loss of high value foraging and commuting habitat might affect the viability of an area to support bats in the long term.

5.2.10 The proximity of a roost to the operating road might affect the long-term suitability of the roost for use by bats as even subtle alterations in air flow, the accessibility of roost entrances and the availability of nearby shelter can affect bats' use of a roost or the likelihood of the roost being used.

5.2.11 Habitat enhancement might be an indirect result of construction for example the provision of attenuation ponds for the settling of road runoff might enhance the value of areas for bats by creating new drinking and foraging opportunities on maturation where they previously did not exist.

5.2.12 Aside from direct loss of roosts / roost access, high way schemes may damage foraging habitat either by direct land-take and fragmentation, or by indirectly severing commuting routes form roosts, polluting watercourses and waterbodies or through the effects of light spillage (Highways Agency, 2005).

5.2.13 In addition the modification of commuting routes by habitat loss may cause bats to fly into the path of oncoming traffic, leading to direct mortality due to Road Traffic Accidents (RTAs) as per the direct mortality and habitat fragmentation.

Habitat Fragmentation and Isolation

5.2.14 Many of the impacts of habitat fragmentation and isolation are common to the construction and operation phases, and also to the impacts of habitat loss and direct mortality. Impacts include the loss of hedges, fences and tree lines used for navigation by bats, which may be a particularly adverse impact on low flying bats including pipistrelle and *Myotis* species and brown long-eared bats (Limpens and Kapetyn, 1991), causing the isolation of resources and increasing the effort needed to commute between them. This might be exacerbated by the patchiness of roosts and foraging areas used by bats. Severance of commuting corridors and removal of sheltered flyways between patches might affect access to resources and could affect long term survival of populations of bats, particularly where this occurs within 100m of a maternity roost as pregnant females may need to feed closer to the roost (Racey and Speakman, 1987). The effects of direct habitat fragmentation and isolation are coupled with the risk of RTA due to vehicle collision as per direct mortality above.

Construction

5.2.15 Construction impacts of habitat fragmentation and isolation are limited to those short-term impacts caused by the positioning of site compounds, access roads and other construction activities. The locations of construction activities for the proposed AWPR are not known, but the impact assessment identifies potential habitat fragmentation and isolation impacts that could be expected due to such activities.

Operation

5.2.16 Where the road or junctions would pass directly through habitat used by bats, areas of habitat used for roosting, foraging or commuting could be fragmented and isolated. In addition, severance of flight routes used for commuting between areas of habitat, including indirect isolation of Habitat Areas where flight lines would not be directly severed but the road passes between Habitat Areas, could be caused by the operating road. Although mitigation measures might restore some connectivity it is likely that some degree of connectivity would be lost in the long term, with implications for bats' navigation around the landscape and access to resources.

5.2.17 Long term impacts of the proposed scheme would include the presence of lanes of moving traffic which would act as a barrier to movement between habitats within the landscape. This is exacerbated by the constraints of echolocation calls in some bat species including brown long-eared bats (Entwistle et al 1996). Bats might be deterred from crossing the road if their echolocation calls are unable to penetrate to the other side. While this has beneficial impacts in terms of reducing the operational impacts of road mortality, it reduces resource accessibility including roost or foraging habitats, forcing bats to use sub-optimal resources. Similarly the new road might render roosts unviable if it were to pass between the roost and optimal foraging habitat (Rob Raynor, SNH, pers. comm..).

Disturbance

5.2.18 The effects of disturbance would be likely to be most noticeable during construction, in particular during felling and demolition works as bats would modify their behaviour to accommodate disturbance over time.

Construction

5.2.19 Increased human presence and the use of heavy machinery would be likely to cause extra dust, noise and vibration which could cause disturbance to roosting bats and might even cause bats to abandon a roost, especially if works take place at night and if blasting is used in the construction of cuttings.

5.2.20 Night-time working involving floodlighting might cause disruption of foraging and commuting behaviour (Rydell and Racey, 1993). In particular the use of lighting close to a roost might influence emergence behaviour and activity. Bright light could cause bats to move away from an area or to desert a roost.

5.2.21 Changes in site layout due to habitat modification during construction would be likely to bring about changes in local environmental conditions including temperature and humidity regimes. As well as affecting roost suitability such modification might affect emergence and behaviour of bats using the area by altering commuting routes.

Operation

5.2.22 While fast-flying bat species including Leisler's bats, and also pipistrelle bats, could be attracted to the insects which feed over street lamps, slower flying species including brown long-eared, Natterer's and Daubenton's bats would be likely to avoid areas once street lights have been

installed (Rydell and Racey, 1993). It is not known how much lighting provision there is likely to be along the proposed scheme, although the provision of lighting at junctions and along the carriageway would be likely to have wide-ranging implications on the distribution and foraging behaviour of bats, especially if used along river corridors, and near woodland edges.

5.2.23 Maintenance operations can potentially affect bat roosts in bridges or trees and can cause disturbance to bats in roosts (DMRB, 2001). Bats' colonial habits and dependence on buildings and similar structures for roosting also make them vulnerable to repair work, re-roofing and the use of toxic timber treatment chemicals etc. (Schofield and Mitchell-Jones, 2003).

Pollution

Construction

5.2.24 During construction, fluctuation in water regimes in burns, lochs and wetland areas could occur as a result of channel siltation through embankment construction, cutting excavation, culvert installation and provision of temporary access roads and vehicle washing. These would be likely to bring about modifications to the channel bed morphology and water turbidity as per Water Environment and Freshwater Ecology reports in Chapter 39 and Appendix A40.9, respectively. Such fluctuations would be likely to result in modification of the insect prey availability with subsequent consequences for foraging bats. Pollution and impacts affecting aquatic habitats are dealt with fully in the Otter and Freshwater Ecology reports (Appendices A40.6 and A40.10) and are therefore not covered in detail in this report.

5.2.25 The introduction of dust and particulate matter (PM_{10}) into the atmosphere during construction has the potential to affect the availability and abundance of bats' insect prey as well as causing other health risks to the bats using the area.

Operation

5.2.26 Long term alterations in the sediment load and channel morphology of water features due to road surface runoff, and alteration of water quality due to runoff and spills during road construction and operation might affect the availability of insects. Insects are sensitive to changes in water quality over time and so the proposed scheme could change the suitability of water and wetland features for foraging especially by Daubenton's and pipistrelle bats which rely on the insect prey that such habitats provide (Rydell et al., 1994). In addition spills of a toxic nature might pollute drinking water directly and oil on the surface of water would reduce its suitability for drinking. The potential impacts due to pollution have been covered in the otter and river habitat reports.

5.2.27 Maintenance of the highway, such as resurfacing, might involve temporary disturbance if night-time working were used or if verge habitats and associated foraging areas were altered. The effects of pollution are covered in the preceding section.

Beneficial Impacts

5.2.28 Few beneficial impacts would be likely to arise as a result of the proposed scheme in the absence of sensitively designed mitigation measures, and many of the potential beneficial impacts would be balanced by adverse impacts as a result of the construction and operation of the road.

5.2.29 The creation of a linear feature through the landscape might potentially provide linear habitat suitable for connecting alternative foraging and roosting areas – though only if sensitive mitigation planting alongside the road is also included in the design of the proposed scheme. However bats are unlikely to use a road and roadside habitats in preference to existing linear features including drystone dykes, tree lines and waterways, and care must be taken in order to avoid increasing the risk of traffic casualties by attracting bats to the road, as indicated earlier.

5.2.30 Road lighting has the potential to attract insects and is considered a reliable food source, and while *Plecotus* and *Myotis* species tend to avoid lights to escape predation from birds, pipistrelle bats will swarm around lamps and feed on insects (Rydell and Racey, 1993). However it has been observed that such behaviour is associated with an increased risk of road traffic casualties as well as an increased risk of predation (Highway Agency, 2005).

5.2.31 The proposed scheme would result in reduced traffic flows on existing roads which currently lack mitigation measures. Although no bat RTAs have been recorded in the study area it is likely that a number of incidents go unrecorded. The reduction in traffic speeds along unmitigated roads might thereby help to reduce direct road mortality on these roads. However this beneficial impact is unlikely to be outweigh direct mortality as a result of other impacts of the road.

5.2.32 The impacts referred to in this report refer only to the potential to affect bats and their behaviour and viability. The impacts on the inherent ecological value of the habitats in question can be found in the Terrestrial Habitats report (Appendix A40.1) and the Freshwater Reports (Appendix A40.9).

5.3 Specific Impacts

Section FL1

5.3.1 During construction, there is a risk of direct mortality where the road would pass through Megray Wood and through woodland habitat adjacent to Megray Burn and Fishermyre. These impacts have been assessed to be high negative magnitude and Moderate significance. Fragmentation would be an issue at Megray Burn and the farm access track where commuting routes are to be severed and at Limpet Burn where the eastern edge of Megray Wood would be fragmented. In addition, there is a potential for disturbance to bats roosting at New Mains of Ury during junction construction. Disturbance to foraging and commuting bats in Megray Wood and Limpet Burn is likely if night works are used and during bridge construction at Limpet Burn. In terms of fragmentation and disturbance, these impacts are assessed as being of medium negative magnitude and Moderate significance.

5.3.2 During operation of the proposed scheme, there would be a risk of direct mortality as a result of the scheme severing known commuting routes along Megray Burn, a farm access track, Limpet Burn and two minor roads that have been shown to be used by commuting bats. These impacts are assessed as being of medium negative magnitude and Moderate significance.

5.3.3 Habitat loss of low value conifer plantation adjacent to Megray Burn and Fishermyre is unlikely to constitute a significant impact. However, the loss of high value foraging and roosting habitat in Megray Wood and adjacent to Limpet Burn would be of a greater severity and are assessed as being medium negative magnitude/Moderate significance. The effects of severance of a commuting route along Limpet and Megray Burns, the farm access track and the minor roads would result in areas becoming less accessible. Pollution incidents at Limpet Burn could result in an significant impact to foraging bats if the suitability of Limpet Ponds as foraging habitat is reduced. These impacts have been assessed as medium negative magnitude and Moderate significance. Some disturbance may occur as a result of junction lighting at Megray Burn, but is anticipated to be minor. Impacts arising from habitat loss at Megray Burn and Fishermyre, together with severance and disturbance are assessed as being low negative magnitude and Minor significance.

Section FL2

5.3.4 During construction, direct mortality has been identified as a potential impact along the Burn of Muchalls where a number of trees with roost potential have been identified. The potential impacts associated with the felling of these trees have been assessed as being high negative magnitude and Major significance. Disturbance would occur at Woodview and Elrick Farms where roosts have been identified within 200m of the proposed scheme, particularly if site compounds are sited

nearby. These impacts have been assessed as being of medium negative magnitude and Moderate significance.

5.3.5 During operation, direct mortality would occur along a farm access track south of Burnside, the Burn of Muchalls and the Burn of Blackbutts as a result of the severance of commuting routes. These potential impacts have been assessed as being high negative magnitude and Major significance. The loss of habitat at the Burn of Muchalls would have an impact on the suitability of the burn and riparian zone for foraging and commuting bats if provision is not made for bats to fly along the burn.

5.3.6 The proposed scheme would cause the eastern edge of the heathland area north of Fishermyre to be fragmented with potential implications for foraging and commuting bats. Severance of the Burn of Muchalls would result in the loss of habitat either side of the road if bats cannot cross. These impacts have been assessed as medium negative magnitude and Moderate significance on these regional value habitat areas. Potential impacts related to disturbance from traffic noise is anticipated to be minor. The potential for pollution of the Burn of Muchalls from road runoff would reduce the suitability of the burn downstream for foraging bats. These impacts are assessed as being of medium negative magnitude and Moderate significance.

Section FL3

5.3.7 The risk of direct mortality as a result of the loss of habitat is anticipated to be minor as the habitat is of low value to roosting bats. The potential for disturbance where the proposed road would be within 50m of the common pipistrelle roost at North Cookney Croft is anticipated to be low and impacts are assessed as being of low negative magnitude and Minor significance.

5.3.8 The impacts of direct mortality would be considered significant where the road passes close to a pipistrelle roost at North Cookney Croft as roosting bats may fly into the path of oncoming traffic if a safe crossing was not provided. There is also the potential for severance and the risk of direct mortality at that location and along the track adjacent to North Rothnick Farm. These impacts are assessed as being high negative magnitude and Major significance. Bats roosting in the houses at Cookney would be likely to disperse to the east and north along the road. The loss of valuable foraging and roosting habitat is not considered likely to be a significant impact in this section as most of the habitat is open, often exposed and of relatively low inherent value. The loss of habitat along linear features, of potential value as commuting routes, is considered to be more important. With the exception of the loss of valuable foraging and roosting habitat, which is assessed as being of medium negative magnitude and Moderate significance, impacts arising from dispersal and disturbance are assessed as being of low negative magnitude and Minor significance.

6 Mitigation

6.1 Introduction

6.1.1 This section of the report outlines measures to prevent, reduce or offset the adverse effects of the proposed scheme on the bat species and habitat features. Where impacts cannot be prevented or reduced to acceptable levels, compensation works will be carried out to offset the adverse effects. The level of mitigation should be proportionate to the size and scale of impact predicted and the status of the bat population to be impacted. Habitat loss should be compensated for on at least a like-for-like basis, by providing equivalent habitat in terms of area of land, numbers of trees and the species of tree or shrub to be lost (taking into consideration that some foraging habitats can take long periods of time to establish and to act as an effected replacement for that which has been lost)

6.1.2 The Bat Mitigation Guidelines (Mitchell-Jones, 2004), Habitat Management for Bats (Entwistle et al 2001) and the Design Manual for Roads and Bridges (HA 80/99) as well as British Standards and National Planning Policy Guidelines (NPPG), consultation with the Aberdeen Bat Group and SNH and professional judgement were used in determining the design of mitigation measures for bats.

6.2 Generic Mitigation

6.2.1 Generic mitigation measures to be adopted across the scheme are described in Table 14. A precautionary approach has been adopted whereby generic mitigation has been recommended wherever adverse impacts on bats and bat populations has been predicted, even in areas where no bats were recorded in surveys. This approach is necessary due to the seriousness of offences made under UK and European law in relation to bats and to ensure that the targets and objectives of the UK and local BAPs are met and to ensure there is no overall decline in bat populations.

6.2.2 A pre-construction Bat Mitigation Strategy will be developed to ensure that effective and appropriate mitigation can be planned and implemented before any impacts on bats are likely to occur. This will include the regular monitoring of potential roost sites, including trees and buildings, which would be likely to be affected by the proposed scheme. Such a strategy will ensure mitigation is effectively undertaken and avoid delays in construction programming due to bat mitigation measures. For each section of the route, the bat mitigation strategy will include detailed method statements to cover all mitigation measures required to prevent, reduce and offset identified impacts.

6.2.3 Mitigation aims in the first instance to avoid direct mortality and disturbance of bats by appropriate timing and methods of working. Where this is unavoidable, licenses will be applied for from the Scottish Executive (SEERAD) under the advice of Scottish Natural Heritage.

6.2.4 Habitat enhancement works, such as roost provision will be in place and effective prior to commencement of construction, so that alternative roosts can be established before old roosts are lost. In the long term habitat maintenance and management will be given priority to ensure that the population will persist. Post-development monitoring of bat populations will be undertaken to assess the success of the scheme and to inform continuing management plans.

Table 14 – Generic Mitigation Measures

Impact	Mitigation type	Construction
Direct mortality	Prevent	Direct mortality to be prevented by detailed surveys by licensed bat workers to locate roosts in built structures and trees prior to construction including properties to be demolished. Felling and demolition must take into account findings of examination. If bats are likely to be disturbed, works must cease and advice must be sought from SNH including an application for a SEERAD licence (DMRB, 2001). Felling and demolition must be carried out by experienced contractors and under the supervision of licensed bat workers. Trees with roost potential must be removed by soft felling with retention of features suitable for roosts to provide natural roost opportunities in newly created/modified areas (Cowan, 2003). Limbs must be removed and lowered in sections using straps and with cracks wedged open, and left lying on the ground for 24 hours (48 in cold weather) prior to removal from site to allow any concealed bats to disperse. Road traffic casualties must be avoided by the provision of safe crossing points for bats. Where the road severs flight lines, and in particular where the road is on an embankment, planting will reduce the risk of collision with oncoming vehicles by forcing bats to fly over the top. Bridges and culverts have also been shown to be used as safe crossing points by bats (Bach and Limpens, 2004) where they are enhanced by guiding or sheltering vegetation or structures along the bridge. Crossing points include 'up and over' hedges and trees between 2-6m high, alterations to proposed underpasses (see Badger report in Appendix A40.2 and Otter report in Appendix A40.5) and sensitive design of road and right of way crossing points to enable bats to use them will be used to prevent bats flying over the road.
	Reduce	Demolition and felling must be undertaken outside sensitive times of year which are mid-May – October for maternity roosts, the end of October and mid-April for hibernacula and mid-April – mid-May and October for potential roosts with unknown status. Monitoring of bats' use of crossings including underpasses, overbridges and culverts must be undertaken regularly during the operation of the proposed scheme to assess whether additional provision is necessary to reduce RTA. Monitoring of bat activity will be a requisite of operational aftercare management contracts.
	Offset	Where current or past signs of bat roosts are discovered in trees or buildings to be unavoidably removed, replacement roosts must be provided and monitored with emergence counts prior to removal. Removal of roosts must proceed when bats are not in residence. Exclusion of the colony may be attempted by blocking access points after natural dispersion and before their return (DMRB, 2001). The site specific exclusion methods will be detailed as part of the licence agreement. Where alternative crossing points are provided, tree planting must be positioned to guide bats toward the crossing point. In locations not identified as crossing points, roadside planting must use trees which do not produce nectar or attract insect prey and must be at least 10m from the road to ensure bats do not try to cross (Lemaire and Arthur, 1999).
Habitat loss	Prevent	Habitat loss will be prevented by removal of trees and buildings only where there is no alternative, and within the minimum area necessary. Works compounds, storage sites and access roads must be located at least 30m from roosts and avoid areas of woodland, wetland and scrub to prevent degradation of valuable bat habitat. Where loss or degradation of valuable habitat is unavoidable and where watercourses are realigned they must be returned to their former quality or improved once construction is complete. Works must follow BS 5837 (1991) guidance for trees in relation to construction, to avoid damage to the tree. Trees to be retained must be safeguarded from damage according to BS 5837 (1991).

Impact	Mitigation type	Construction
	Reduce	Some felled trees must be left in areas of woodland clearance to provide foraging habitat and egg laying habitat for insect prey larvae. Loss of aquatic habitats must be kept to a minimum, including retention of bankside vegetation, natural water features including pools and riffles and dredging must be kept to a minimum as it destroys vegetation and associated insect abundance. This will help meet conservation targets for Daubenton's bats in line with the LBAP. Maintenance works on newly planted habitat will include coppicing and pollarding to provide future roost opportunities and maximise prey diversity for foraging bats (Entwistle et al 2001). Freshwater habitats including attenuation ponds and drainage channels, and woodland edge and hedgerow habitats, especially those within 1km of roosts, must be managed to increase prey diversity to maintain value as flight lines and foraging areas. Maintenance of existing habitat of value to bats to be retained and creation of new habitat to occur. Landscape planting must be undertaken using locally obtained native species typical of the area. The value of existing woodland features to be increased by avoiding monoculture planting to provide diversity and thus support a variety of insects.
	Offset	Where older trees and those with suitable crevices are to be lost (due to construction and operation phases) bat boxes will be erected to provide alternative roost sites and offset those to be lost until replacement trees have matured. Bat boxes have been shown to be readily used by the types of species recorded along the survey corridor e.g. Daubenton's bat and pipistrelle species (DMRB, 2001). Many more replacement roosts will be needed than the number of trees and buildings to be lost in order to increase the likelihood of being discovered and used by bats and to replace roosts which may be abandoned due to proximity to the road. It is recommended that boxes be installed at a ratio of 4 boxes per tree with roost potential to be replaced. Bat boxes must be located according to the following criteria in order to increase the likelihood of bats using them: Boxes must be sited at least 30m away from the proposed scheme to prevent attracting bats to the road. A mixture of box types must be used to cater for seasonal and species requirements (Mitchell-Jones, 2004). Durable woodcrete (Schwegler) boxes require less maintenance, are longer lived than wooden boxes and offer greater protection against adverse weather conditions (Cowan., 2003). Further surveys to determine species and location may be required to enable species specific bat box mitigation. - Boxes must be sheltered from extreme weather conditions and positioned in a range of different aspects to ensure a range of temperature conditions. - Boxes will be sited in areas where bats feed frequently and will be planned to maximise the chances of bats finding them, for example near existing flight lines. - Obstructions including overhanging vegetation will not restrict access to the roost. There should be at least a 3m clear drop under the box and 1m space in front, above and to the sides. - Boxes will be placed 4-5m above the ground to avoid disturbance including vandalism and taking into account that boxes will need to be monitored. - Provision of nursery roosts and hibernacula is particularly important as they are harder to find. Loss of long term foraging and roost habitat will be offset by compensation planting of broadleaved trees (oak, ash, beech) of local provenance on a like for like basis. More trees should be planted than are to be removed during works to increase chances of trees reaching maturity. Habitat creation recommended for other species for example birds and otters will also benefit bats. Habitat creation schemes will contribute toward targets

Impact	Mitigation type	Construction
		in Local and National BAPs for pipistrelles and Daubenton's bats. A bat box monitoring and maintenance programme will be established in conjunction with the local bat group and monitoring will continue during the aftercare and operation of the road. Bat boxes will be monitored by suitably licensed bat workers twice a year in April/May and September to avoid disturbance to bats with young and hibernating bats (Mitchell-Jones, 2004). The species and number of bats will be recorded and bat boxes not used within 3 years will be repositioned in alternative sites nearby.
Habitat Fragmentation and Isolation	Prevent	Habitat fragmentation and isolation will be avoided during construction by sensitive location of works compounds and storage sites so access to important areas of bat habitat or roosts is not compromised. The operational scheme will not prevent bats from moving freely within and between available habitat areas. This includes maintaining connectivity between foraging and roost areas and retention of known flyways. Culverts and tunnels have been shown to be used by bats including pipistrelles, Natterer's and Daubenton's bats, which have also been recorded flying longer distances to use tunnels rather than flying directly over a motorway, even where the tunnel is narrow or long, supporting their role in conservation of connectivity of landscapes (Bach and Limpens, 2004). Underpasses and culverts including those which have been identified in the badger report will be provided at suitable locations where flyways are known to cross the proposed scheme. These must be at least 1.5m x 1.5m in cross section (Brinkmann et al 2003) and preferably allow water to flow through and include lead-in structures or planting in order to increase chances of being used.
	Reduce	New and diversionary flight lines will provide roost opportunities to provide resting points for energy expensive detours. Woodcrete bat boxes will be provided in (Schwegler IFQ 56.5 x 35 x 8.5 cm dimensions) non structural elements of bridges to provide roosting habitat. Where possible, woodland rides will be maintained and natural regeneration encouraged in gaps to offset isolation in the long term.
	Offset	Habitat fragmentation will be offset by the provision of vegetation along verges and embankments to establish connectivity of landscape features for bats. Habitat creation will aim to fill in existing gaps in linear vegetation features and, where possible, new areas of woodland will adjoin existing blocks or act as stepping stones between neighbouring woods or connecting tree lines (Entwistle et al 2001) Where planting is recommended to provide continuity of habitat, temporary fencing will be provided to maintain flight lines until trees have matured. This will have the added advantage of providing shelter for insects enabling bats to forage en route. Barriers and environmental corridors will be designed with consideration to DMRB (2001). A crossing monitoring programme will be established to assess its success.
Disturbance	Prevent	Site compounds and construction activities including plant and accesses and especially activities such as blasting which have a high impact on the surrounding area will be confined to the minimum area required for the works and temporary work areas and according to construction standards. In particular, they will not be sited on areas of important habitat for bats or within 30m of roosts to prevent disturbance to bats using these areas. Roosts will be identified to contractors to ensure that they are not accidentally disturbed. Trees to be retained will be safeguarded from damage according to BS 5837 (1991). Night works will be avoided during construction if bats are present – in particular during the summer months (May to September) when disturbance to bats during peak activity times and when nursing young may influence behaviour. Night working will only be undertaken with the agreement of SNH. Bat roosts will not be directly illuminated and lighting will be avoided altogether near woodland edges and ponds. If a building or tree containing a roost is to be illuminated there will be a curfew point at which lights are switched off (bat emergence time and during peak activity times). Roosts will

Impact	Mitigation type	Construction
		not be illuminated after 8.30 pm between May and September. The advice of bat specialists will be sought in the design of junction lighting
	Reduce	As for direct mortality, thorough inspection of buildings and trees within 30m of works will be carried out prior to works to establish roost status. Where roosts are identified in close proximity to the road, barriers will be erected to avoid disturbance by lighting, vibration, noise (including night working) and to avoid traffic accidents Night working (between sunset and sunrise) will be avoided near to roosts to prevent alteration of bat emergence and social behaviour. The level of and provision of lighting including roadside and works will be kept to a minimum according to BS 5489 and the ILE Guidance for the Reduction of Light Pollution (The Institution of Lighting Engineers, 1992). Low pressure sodium lamps will be used in preference to high pressure sodium or mercury lamps and the brightness will be kept as low as possible by directing the beam downwards using hoods and limiting the height of lighting columns.
	Offset	Provision of alternative roosts (see bat box criteria above) where disturbance to current roosts is likely to be unavoidable (due to the road being less than 30m away). Natural screens will be provided along the scheme to offset disturbance caused by noise and vibration (see also reports in Chapters 41: Landscape and 42: Visual).
Pollution	Prevent	Site management practices to minimise the risks of secondary impacts to habitat adjacent to the proposed route will be adopted. Surface and foul water will be appropriately drained and stored. Chemicals, oils and fuels will be kept safely stored and away from water features and waste will be appropriately managed. Sites will be restored fully on completion of works and contractors will adhere to SEPA PPG guidelines (SEPA, February 2003) with respect to preventing pollution incidents near watercourses and water features. PPG 1 – General Guide to Prevention of Water Pollution; PPG 3 – Use and Design of Oil Separators; PPG 5 – works In, Near or Liable to Affect Watercourses; PPG 6 – Working at Construction and Demolition Sites; and PPG 21 – Pollution Incident Response Planning. Details regarding pollution control can be found in the Otter Report (Appendix A40.5) and Freshwater Ecology report (Appendix A40.9) Road runoff will be treated using SUDS techniques including collection in treatment facilities including petrol interceptors, silt traps and balancing ponds according to SEPA PPC guidelines (SEPA, February 2003) as per mitigation during the construction phase.
	Reduce	Levels of dust will be minimised so that this does not build up significantly on trees and scrub vegetation.

6.3 Specific Mitigation

6.3.1 Mitigation for bats is aimed at maintaining populations (particularly breeding populations), minimising disturbance, maintaining access for bats to their present foraging habitats, allowing existing populations to expand and colonise new areas and minimising the risk of road traffic accidents involving bats by:

- prevention of direct mortality by the exclusion of roosts that are to be destroyed. A licence must be obtained from the Scottish Executive Environment and Rural Affairs Department (SEERAD) at least a year in advance of development commencing. It is not necessary to demonstrate that bats are using replacement roosts prior to destruction, however replacement roosts must be provided prior to works;
- ensuring that construction activities, including the felling of trees and destruction of buildings, will be timed to avoid periods when bats are sensitive to disturbance, i.e. summer and winter. Such features will be rigorously inspected immediately prior to their removal by licensed ecologists and a precautionary approach will be adopted to prevent any bat mortalities, e.g. the sectional felling of trees in autumn;
- the use of screens to protect bats which may be roosting in trees during construction
- delineating a 50m buffer around all bat roosts (that are not to be excluded and destroyed). No construction activities that constitute 'disturbance' to bats will take place within a 50m buffer zone;
- ensuring that trees that are to be retained must be safeguarded from damage in accordance with the guidance provided in BS 5837 (1991);
- designing, where appropriate, culverts and underpasses for bats that are at least 1.5m x 1.5m in cross section (Brinkmann et al., 2003). Previous studies have shown that appropriately sized structures will be used by bats (Bach and Limpens, 2004). These structures are also to be included as mitigation for badgers and otters;
- bat boxes will be erected on buildings, where appropriate, and in agreement with the landowner Similarly, woodland areas lost as part of the scheme will be replaced at nearby suitable locations and existing areas of habitat enhanced;
- linear habitat planting alongside the scheme will be incorporated along bat flyways and within 50m of bat roosts to direct bats over the scheme, therefore preventing direct road mortality from occurring;
- night-time working will not be permitted without agreement from SNH. Carriageway lighting will only be provided where necessary for road safety to minimise impact on bats;
- the use of Sustainable Urban Drainage Systems (SUDS) to manage pollution incidents; and
- areas of riparian woodland will be created alongside burns to offset habitat loss and minimise disturbance through noise reduction. These woodlands will include species of local importance such as wych elm and aspen as well as willow, birch and alder.

6.3.2 A licence can be granted under Section 44 of the Conservation Regulations 1994 that will permit certain actions, which would otherwise be against the law, to be carried out under certain circumstances and where an action is deemed necessary; including where approved development is taking place. Such actions include the killing, injury or taking of bats, or the destruction, damage or obstruction of access to any place used by bats for shelter, protection or breeding including within a dwelling house. The licensing system is provided by SEERAD but the advice of SNH will be sought prior to any such damage and their advice followed.

6.3.3 This advice will be sought in the form of the development of 'ghost licences', which will mirror the contents of the full licence. This approach will enable the development of a method and the full information required to ensure SNH are comfortable that the approach will fulfil the conservation

regulations and maintain the favourable conservation status of the species concerned. Three tests must be granted before a licence may be granted and if any of these tests fail the licence application will be unsuccessful. It must be demonstrated that:

- the reasons for the works must be clearly stated;
- there is no satisfactory alternative to granting a licence; and
- the action proposed will not be detrimental to populations of the species concerned at a favourable conservation status in their natural range.

6.3.4 The conservation status will be taken as 'favourable' when the following criteria are met:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats;
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

6.3.5 As much information as possible will be provided during the licence application process, including the following:

- information on the numbers of numbers of animals, habitat type and locations to be affected including details and results of surveys;
- details of the action to be taken and the methodology that will be taken; and
- details of discussions with SNH and any other relevant information.

7 Residual Impacts

7.1.1 This section presents the results of the assessment of residual impacts following the effective implementation of appropriate mitigation.

Direct Mortality

7.1.2 Provided that the mitigation measures proposed are successfully implemented and all roosts are located prior to felling and demolition works during construction, the risk of accidental deaths of bats should be prevented. Impacts resulting from RTA during operation of the proposed scheme will be significantly although reduced isolated incidences of RTA may still occur. In addition, it is expected that bats will gradually adapt to the new landscape. The provision of safe crossing points including bridges, underpasses and box culverts combined with the provision of planting at the most sensitive areas will therefore maintain the long term viability of bat populations within the route corridor. The bat populations are unlikely to be compromised and in this respect potential impacts resulting from direct mortality are anticipated to be reduced from high negative magnitude and Minor to Major significance (pending contemplation of the value of the resource) to negligible magnitude and Negligible significance.

Habitat Loss

7.1.3 Bats are vulnerable to impacts arising from habitat loss. It is likely that short to medium term habitat loss (in terms of roosting and foraging habitat) will affect bat populations within the route corridor as newly created habitats are unlikely to provide instant good quality replacement foraging, roosting or commuting opportunities until they mature. The loss of roosting habitat, in particular the loss of tree roosts, in the short-term will be mitigated for by using bat boxes or similar structures. Habitat loss in the long term will be mitigated by new habitat creation and enhancement and provided the mitigation measures are implemented successfully the long term viability of bat populations will not be compromised. These residual impacts are assessed to be low negative magnitude and Minor

significance in the short to medium terms and negligible magnitude and Negligible significance in the long term.

Habitat Fragmentation and Isolation

7.1.4 Despite the incorporation of bridges and culverts enhanced by planting to guide bats safely towards crossing points, construction of the proposed scheme would result in short term residual severance of commuting routes and foraging habitat within the route corridor until new habitat has time to mature and bats adjust to these new landscape features. Research has suggested that bats will use these structures even if they are long and narrow (Bach & Limpens, 2004). However, there is potential that proposed culverts greater than 100m in length may not be used by bats, especially when water levels are high.

7.1.5 In the long term, it is expected that bats would gradually find alternative routes and new features along which to echolocate. Woodland habitat creation and the provision of linear habitats will maintain and enhance connectivity between habitat fragments on each side of the road and along its length in the long term. Habitat fragmentation and isolation residual impacts have been assessed as low negative magnitude and Minor significance in the short term and negligible magnitude and Negligible significance in the long term.

Disturbance

7.1.6 Impacts from disturbance of roosts and foraging/commuting areas during construction and initial operation of the proposed scheme will, in the short term, occur. However, these impacts will be significantly reduced through the implementation of applicable mitigation measures and sensitive phasing of construction works, especially if considerable effort is made to locate roosts prior to works commencing. Long-term disturbance during operation of the scheme is not anticipated to be a significant impact. Light pollution would occur at certain locations be of benefit to foraging bats. The residual impacts of disturbance are therefore predicted to be of Low Negative/Minor in short term and negligible magnitude and Negligible significance in the long term.

Pollution/Other Indirect Impacts

7.1.7 The implementation of measures to prevent pollutants and runoff from entering watercourses or other waterbodies during construction and operation of the proposed scheme is expected to mitigate for all identified impacts. The residual impact assessment has been assessed as negligible magnitude and Negligible significance.

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9 Glossary of Terms and Acronyms

DMRB – Design Manual for Roads and Bridges – Highways Agency guidelines to be taken into account when planning a road development

DWS – District Wildlife Site

EcIA – Ecological Impact Assessment – Statutory requirement for the assessment of impacts of proposed development schemes on ecological receptors

Echolocation – Ultrasonic signal used by bats to navigate and locate insect prey

Flight Line (also flyway) – a route, usually along linear or habitat feature, which is used by bats for commuting between landscape features

Hibernation – Extended period of torpor undertaken over the winter

LBAP – Local Biodiversity Action Plan. Local targets and objectives for named species of conservation concern.

Roost – any resting site used by bats including maternity roosts which are used by females and their young, hibernacula which are used during winter hibernation and transitional roosts which may be used at any time

RTA – Road traffic Accident

SINS – Site of Interest to Natural Science

SNH – Scottish Natural Heritage, Government Agency concerned with the

SSSI – Site of Special Scientific Interest

Torpor – physiological state which bats use to conserve energy during the day and during poor weather conditions

UK BAP – UK Biodiversity Action Plan. National targets and objectives for named species which may be adopted by local authorities to influence management decisions with regard to species of conservation concern.